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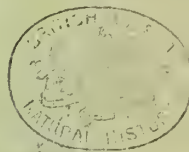
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THE
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EDITED BY JOHN H. COOKE, B.Sc., F.G.S.



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MALTA, JUNE 1st, 1892.

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NOTICES.

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Subscribers are requested to note that Volume II, commences with the present number.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

A year's insect-hunting at Gibraltar.

BY JAMES J. WALKER, R.N., F.E.S.

The insect fauna of the south of Spain has been investigated by such well-known Entomologists as Rambur, Graslin, Rosenhauer, Diek, &c.; but, as far as I have been able to ascertain, nothing has been published respecting that of our British possession at Gibraltar and the immediate neighbourhood, except some notes on the butterflies in the "Entomologist" (Nos. 257 and 247, Nov. and Dec., 1884). As I have had ample opportunities of collecting in this very interesting locality since my appointment to H. M. gunboat "Grappler" stationed here, I venture to put my experiences on record, as a contribution to the knowledge of the entomology of this extreme southern corner of the European continent, prefacing them with a brief account of the chief physical and botanical features of the district.

The Rock of Gibraltar is a huge isolated mass of hard greyish-white limestone of Jurassic age, about $2\frac{1}{2}$ miles in extreme length, with a varying width, at the sea-level, of from 440 to 1300 yards. A level, sandy isthmus, scarcely ten feet above high-water mark in any part, connects it with the Spanish mainland, and from this the northern face of the Rock rises in one magnificent vertical precipice to a height of over 1200 feet. Thence, for rather more than a mile, the crest of the Rock is a narrow knife-edge ridge, running nearly north and south, and varying in height from 1356 feet near the north end, to only 660 feet at less than a quarter of a mile south of this point. It again rises to 1275 feet at the Signal Station, near the middle of the ridge, and attains its greatest elevation (1386 feet) between this spot and "O'Hara's Tower," which surmounts its southern extremity. From here the Rock descends in a series of grand precipices to the "Windmill Hill Flats," some 400 feet above the sea, and again sinks abruptly to Europa Point, which presents a cliff of about 50

feet high to the Straits. Except at "Catalan Bay," where a short sandy beach affords a site for a little village, chiefly inhabited by Genoese fishermen, the east side is quite inaccessible, being a succession of immense slopes of loose sand and gravel, standing at a steep angle, and crowned by vertical walls of rock, or else rising in an unbroken precipice from the waters of the Mediterranean. The west side, although very rugged and in many places quite precipitous, is, on the whole, of a comparatively easy slope, and several good paths lead to the summit.

Although the actual height of the Rock is quite insignificant, it can scarcely be surpassed in the striking grandeur of its appearance, and from its summit may be obtained, on a clear day, a most extensive and charming view, embracing the whole of the Straits, and the Mediterranean shores nearly as far as Malaga with a glimpse of the distant "Lesser Atlas" in Morocco. From its abruptness and isolation, the Rock is a great "weather-breeder," and when an easterly wind or "Levanter" prevails, as it does throughout most of the summer, the top is hidden for days together by a heavy pall of misty cloud stretching far across the Bay, while the sun is shining brightly over the adjoining country. Though the town, situated at the western foot of the Rock, is exposed to the full influence of the afternoon sunshine, the summer heat is never excessive, rarely exceeding any time 85° in the shade. February is the coldest month, frost and snow being very rare, although not quite unknown. The average annual rainfall is about 36 inches, nearly all occurring between October and April: by the end of August the whole country, unrefreshed by a shower for the past three months, becomes as dry and brown as a high road. In this genial climate some of the butterflies continue on the wing the whole year round, and there is scarcely a sunny day in any month on which specimens of *Pieris brassicae** and *rapae**, *Colias Edusa**, *Satyrus Egeria**, *Pyrameis cardui** and *Atalanta**, and *Chrysophanus Phlaeas**, may not be met with in sheltered places.

Much of the western side of the Rock, above the town and its fortifications, is covered with a dense bushy vegetation, most luxuriant towards the southern end near the summit. The flora of the district is, indeed, by no means a scanty or

insignificant one, no fewer than 484 species of flowering plants being enumerated by Dr. Kelaart (Flora Calpensis, London, 1846) as occurring on the Rock itself and the small adjoining piece of sandy ground extending to the Spanish line: of these some 32 are introduced or cultivated, leaving the large number of 452 natives to Gibraltar. The dwarf palm, *Chamaerops humilis* forms a conspicuous feature in the vegetation of the Rock, and in the early spring months of February, March, and April, the abundance and beauty of the wild flowers (*Boraginaceae*, *Compositae*, *Labiatae*, *Orchideae*, and *Liliaceae*, predominating) is very striking. The pretty Crueifer, the *Iberis gibraltaria*, of Linné, has its only European station here, its large lilac flowers adorning the rock-faces in April and May, and, earlier in the year, the trefoil leaves and golden yellow blossoms of *Oxalis corniculata*, Thunb., an introduced Cape plant, cover large spaces on the lower slopes. At the back of the Alameda, or public garden, is a good sized grove of Scotch firs, but on the whole, trees are rare, except in the gardens, and planted along the road sides. In these situations may be seen fine examples of the plane, the acaëia, the locust tree (*Ceratonia siliqua*, L.) the Australian blue gum (*Eucalyptus globulus*) the graceful *Schinus molle* of the Andes, here called the pimienta or pepper tree, and the Chinese *Phytolacca dioica*, or "bella sombra," remarkable for the immense enlargement of its soft-wooded trunk just above the root: with the usual South European fruit trees, and an occasional date palm, the fruit of which, however, rarely, if ever, ripens here. The prickly pear (*Opuntia*) and the *Agave americana* are thoroughly naturalized, and are much used in the neighbourhood to form hedges.

As is well known, the Rock is the sole European locality in which the Barbary ape (*Macacus inuus*, L.) is found in a wild state. These animals reduced a few years ago to less than a dozen individuals have of late increased greatly in numbers, and being strictly protected, are very bold and fearless. The fig trees in the gardens suffer so much from their depredations when the fruit is ripening, that it is found necessary to employ men to scare them away. The Barbary partridge (*Caccabis petrosa*, Gmel.), though numerous on the Rock as well as on the opposite African coast, is,

like the monkey, found nowhere else on the European continent. The osprey, the peregrine falcon, the Egyptian vulture, and Bonelli's eagle (*Nisaetus fasciatus*, Viell.), breed sparingly on the higher crags. A very great number of species of fishes is found in the Bay and the adjoining waters, and a visit to the market especially in the early morning, rarely fails to reward the naturalist with the sight of many interesting and often rare forms.

Leaving the town by the "Landport" gate at the north end a short walk brings one to the flat, sandy isthmus, of which the British lines enclose a trip, from sea to sea, about a quarter of a mile long, used as a race course and rifle range; a similar strip between the British and Spanish lines being "neutral ground." When I was here in 1874-5, the race course was marked out with large loose stones, under which *Coleoptera* congregated in myriads, but these have long since been removed, much to the detriment of collecting, still, the abundance of large beetles here is very striking at all times of the year, but especially in the spring and early summer. The big, unwieldy *Morica planata*, F., *Pimelia fornicata*, Sol., and *Akis acuminata*, F., are to be seen everywhere waddling clumsily about, and a little closer search will not fail to reveal *Scaurus tristis*, Ol., and *punctatus*, Hbst., *Crypticus gibbulus*, Quens., *Erodium tibialis*, L. two species of *Zophosis* and of *Stenosis*, *Tentyria marocana*, Sol., and other interesting Heteromorous forms; while, especially towards evening, the truculent-looking *Scarites gigas*, L., is often to be seen prowling over the sump in search of prey, having quitted his burrow at the roots of a tuft of *Ononis*. Beyond the Spanish lines is the village of "San Felipe de la Linea," which straggles over a large extent of ground, and is, I may safely say, the most filthy and squalid place I have ever seen. There is, unfortunately, no way of reaching the open country except through this delightful village, and even when the pedestrian has run the gauntlet of its thousand and one evil odours, his troubles are not yet at an end. The path for the next mile or so is along the sandy beach of the Bay, which is, except under certain conditions of the tide, exceedingly fatiguing to traverse, being cut up by the hoofs of innumerable beasts of burden, chiefly of the humbler sort. Another path leads through

Linea to the foot of the Sierra Carbonera, or as it is called in Gibraltar, the "Queen of Spain's Chair," but this also traverses a mile or more of clean, loose, sea sand, drifted into hillocks by the wind, and entirely destitute of vegetation. The eastern (Mediterranean) beach is very dreary and barren, and the only noteworthy insect I have found here is *Nebria Complinata*, L., not uncommonly under large pieces of wreck timber, in in company with *Trachyscelis aphodioides*, Latr. On the western beach, such beetles as *Isocerus purpurascens*, Hbst., *Crypticus pruinosis*, Duf., *Helops pallidus*, Curtis., *Ammophthorus rugosus*, Rosh., two species of *Phaleria* and *Psammodius porricollis*, Ill., may be found at almost any time at the roots of sea spurge, and the conspicuous black and white spotted larva of *Brithys pancratii*, Cyr., is common on the sea lily, *Pancratium maritimum*, eating the leaves down to the sand. This sandy beach extends to Algeiras, a distance of 12 miles round the Bay, and is intersected by the mouths of two small rivers, the Guadarranque and the Palmones, as well as by some minor streams.

(to be continued)

Why We Should Teach Geology.

Geology in its broadest scope should be taught in our schools and colleges, and for at least twelve good reasons, says Prof. A. S. Packard in *Popular Science Monthly* for May. At the outset we would claim that it holds equal rank with astronomy or biology. The former science tells us of the existence of other worlds than ours and gives us some conception of the immensity of space. The study of plants and animals carries an impressive lesson as to the unity prevailing amid all the diversity of Nature, besides affording the hope that we may at some time discover the origin of life, since it has already opened the way to an explanation of the origin of the existing forms of life; while the grand outcome of geological study is that it brings vividly before the mind the immensity of time, enabling us to realize that time is only less than eternity. It also teaches us that our earth has had a history, that our own race has had a high antiquity; and thus the contem-

plation of past geological ages, reckoned by millions of years, the fact that our earth is coeval with the sun in age—all these considerations tend to immeasurably expand our mental horizon, and thus to react in a way to broaden the mind. Geology is also the complement of biology. As soon as one has mastered the rudiments of botany and zoology, and of the distribution of life forms in space, the range of his thoughts should be extended to take in the orderly succession of life in past ages, and the evolution of modern specialized plants and animals from the earlier, generalized types.

The Sulphur Mines of Sicily.

From the report to the State Department of Mr. Chas. Heath, U. S. Consul at Catania, Sicily, we learn that the mining and fusing of sulphur in Sicily are not carried on with the vigour and enterprise that the demand for this commodity might lead us to expect.

The most primitive methods are still employed in the work owing to lack of enterprise, and the difficulty that is experienced in inducing capitalists to invest their money in the industry.

In the majority of mines, machinery is unknown, manual labour taking its place and giving employment to hundreds of women and children who carry the mineral on their heads in baskets from the mine to the surface.

Four systems of melting sulphur are in vogue in Sicily—the Calcherone, the Sinopoli furnace, the steam process, and Gill's furnace. On account of the small amount of capital required the first two are the most popular.

The steam process, which consists of injecting dry steam through iron pipes filled with the mineral is the best method as the product obtained is better in quality and no fumes escape to destroy vegetation around. Gill's process has been extensively tried, but as it requires skilled labour it has now fallen into disuse.

Catania is the great centre for refining the sulphur; while Catania, Licata, and Girgenti are the principal shipping ports.

The Relationship of the Structure of Rocks to the conditions of their Formation.

By H. J. JOHNSTON LAVIS, M.D.

Introduction—Two great questions of Vulcanology, of which our knowledge is still very limited, are in the first place the causes that bring about the wide range in force and character of volcanic activity; and, secondly, the difference in structure and composition of the resulting products. In the present Paper it is proposed to discuss a portion only of these very complex questions.

Those who have lived in a still active volcanic region, and have gazed over the landmarks of former activity, and compared them with those at present in progress, cannot but be struck by the evidence afforded of the enormous disproportion in the exhibition of volcanic energy from one time to another. Before 1631 the crater of Vesuvius was clothed with trees, brushwood, and grass, where goats were pastured, while the only sign of igneous action was the presence of two small lakes of warm water occupying the bottom of that depression. The quietness of the sylvan scene was only broken by the twitter of birds, the shepherd's chant, or the wind-rustled leaves. Let us compare this state of placidity, or still more that in which no sign whatever existed of the endogenous activity in the time of Spartacus, with those gigantic, prehistoric eruptions which tore away 1,000 metres or more of the mountain top, and hollowed out a cavity equal to a cone with a base-diameter of three kilometres and a height of 1400 to 1500 metres. Even the Plinian eruption was an insignificant affair compared with its four predecessors. Between these two extremes in the vital activity of a volcano we have all stages of gradation.

Yet the phenomena of Vesuvius bear the proportion of child's play to a giant's exploits, when we compare them with the catastrophe of Tomboro, Krakatōa, Cotopaxi, the Icelandic volcanoes, and many others. Meditating on these facts can hardly fail to awaken within us the inquiry as to the actuating cause of the variability in functions, if we may so call them, of a volcano.

Source of Energy stored up in Igneous Matter.—Disregarding for the time being the unsettled question of the condition of the earth's interior, let us assume (1) that we have an almost unlimited supply of igneous material; let us then ask ourselves whether this material, supplied in varying proportions, is capable of producing an equivalent difference in the display and character of the volcanic forces. A moment's consideration will satisfy us that such is certainly not the case. There is no doubt that in a great *explosive* eruption a very large amount of matter may be ejected, but as it is always in the form of pumice, its apparent bulk is larger than its real one. On the other hand, in paroxysmal eruptions (2) we have enormous quantities of igneous magma ejected in a fluent form without exhibiting that amount of energy that occurs in the first case. If we compare the amounts, by weight, of matter (*essential*) (3) ejected during the Plinian eruption of Vesuvius with the lava outpours of 1631, we should find no ratio between them and the eruptive energy exerted on each occasion. Many still more striking examples might be given of the gigantic, though comparatively quiet outflows of basalt, when compared with low crater rings of the Eifel and other volcanic districts.

Were facts otherwise, so that the greater the eruption the greater the amount of material extruded, we should then have fairly conclusive evidence that the water which is the main motive power in a volcano was contained uniformly diffused throughout the igneous magma, as held by Rev. O. Fisher and others (4). Of course we must admit that in distant regions such might really be the case, but it is not reasonable to

suppose that it is so in a single locality, a necessary datum for such an argument. In consequence of this we are reduced to search for some local influences that are brought to bear upon an isolated portion of the igneous magma, and the only rational way in which we can suppose any such mass to be isolated would be when it has entered its duct on its way from its source to the surface.

Passing over the older and more crude theories relating to the flowing (1) down of water by crevasses, and so coming in contact with the molten lava, or over the fantastic hypothesis of Davy down to that of Peacock, we find the question severely tackled in 1881 by three eminent geologists: Professor Prestwich, (2) who attributes eruptions to the *perecolation of water to the porosity and cleavage planes of rocks*, and not to fissures, but yet does not admit of that intimate mixture of the water with the magma, which, anyone accustomed to watch the lava in its fluent state, soon becomes convinced of. Professor Sollas (3) at the same time and place recognizes the intermixture of water and lava, and supposes the former to exist in the liquid state, but he fails to explain the variability of eruptive action except by relief of pressure. The changes of pressure, as explained by the author, are obviously insufficient to bring about inactivity on the one hand, or explosive (1) eruptions on the other. Besides, we should expect volcanoes in the same region to act quite synchronously. It is to Professor Judd and Reyer that merit is due for the recognition of the fact that the igneous magma may, under pressure, absorb gases such as water is at high temperatures, and he gives in illustration a number of analogous examples, but does not treat of the conditions of absorption and dispersion of such water.

Just to this point we are provided with a demonstration of what is really the motive power of volcanic eruptions, and it is here I propose to

(1) *This is compatible with all the more reasonable theories regarding the physical state of the deeper parts of our globe.*

(2) *It may be here mentioned that I do not use paroxysmal in the same sense as Serope, but to indicate those increments of activity that occur from time to time during chronic activity, always accompanied by the outpour of lava, leaving explosive for those eruptions with only fragmentary pumiceous or scoriaceous pumice ejectamenta.*

(3) *I mean only that which is really extruded de novo, and not materials torn from the crater sides.*

(4) *Physics of the Earth's Crust, 1881, p. 187.*

(1) *Baron Dietrich in Ferber, Lettres sur la mineralogie, &c., de l'Italie, 1776, p. 207; also Braccini.*

(2) *"Some Observations on the Causes of Volcanic Action."*—Reports, Brit. Assoc., 1881.

(3) *"The Connection between the Intrusion of Volcanic Action."*—Reports, Brit. Assoc., 1881.

take up the thread and discuss the conditions under which this water is absorbed, retained, and expelled.

Let us take an illustration, namely, the solution of carbonic anhydride in water itself. Carbonic anhydride is, at the normal temperature and pressure of the atmosphere, a gas; but by either increasing the pressure or lowering the temperature it may be reduced to the liquid or solid state. The water of volcanoes, at the normal pressure of the air and the temperature of lava, is a gas; and, like carbonic anhydride, may be rendered liquid or solid by increasing pressure or lowering temperature. By removing either of these secondary conditions the more volatile materials in the two cases return to their gaseous state. Now, carbonic anhydride in the presence of water is much more easily condensed, and dissolves simultaneously in that liquid, the solubility proportionally increasing with the pressure. Water is equally soluble in molten silicates, as is shown by its escape from lava, and its solubility likewise increases with the pressure, unless downright opposed to known physical laws. Between these two cases of gases soluble in liquids there is not only a physical, but also a chemical, analogy, for in both cases we have to deal with gaseous oxides soluble in liquid ones.

In the case of the solution of carbonic anhydride in water, and in fact, of solutions of all gases in liquids, we find that the quantity of gas absorbed increases with the pressure, provided the liquid does not solidify (as exhibited in the spitting of silver). We find also that the pressure remaining fixed, an increase of temperature has a tendency to reconvert the condensed, or, more properly, dissolved gas, again into the gaseous state; or, in other words, we find that the tension of such a solution increases with the temperature. The absorption of oxygen by molten silver, and of the same gas and carbonic anhydride by iron and steel, as demonstrated by Troost, are familiar examples of fluids at high temperatures taking up gases. It is at the same time evident that the critical point of water no longer enters into the question, as it is held in solution like CO₂ in water, both occupying volumes much nearer their liquid than their gaseous state.

The conditions under which igneous matter commences its course towards the surface may, no doubt, be very variable, and whether such be due to secular cooling of our globe, and consequent straining and fracturing of its outer surface, it is not our present business to discuss. As already stated, we have every reason to believe the volcanic magma, as it exists in its original site, (1) contains dissolved in it little, if any, water, although many hold, on account of Sorby's discoveries, that the fluid portion of the earth's interior is an *igneo-aqueous* solutions. We must first prove that granite, or at least that studied by Sorby and others, was not an intrusive rock in porous strata. In other words, it must be proved that granite is the *primitive* rock cooled without the intervention of secondary water.

It, therefore, on being transferred from great to lesser pressure, would only exert that small amount of expansion which is proper to its chemical components, which would therefore undergo no change of state, but remain as liquids under normal atmospheric pressure at the earth's surface. In fact, whatever expansion tended to take place in transferring the volcanic magma from great depths to the surface would be more or less balanced by the corresponding loss of heat, and consequent tendency to contract as a result of that, so that only a change in volume would take place, if any, in proportion to the different power of the two *agencies* to accelerate or diminish contraction. This theory of the solution of water in lava, and not lava in water, is incidentally mentioned by the Rev. O. Fisher. (2)

Extrusion of Igneous Matter through Dry, or nearly Dry, Rocks to the Surface.—Should such volcanic magma in its native state reach the surface, it might overflow without any explosive manifestations whatever, and consequently no cone of scoria or other fragmentary materials would be formed around the exit, and the locality of this would be only detected on a plain by the possible formation of domes, or mamellons, where

(1) *Whether this forms the centre of our globe, a stratum between the nucleus and crust, or exist as isolated reservoirs, in no way affects that part of the question now under discussion.*

(2) *Physics of the Earth's Crust, 1881, p. 190.*

the lava was sufficiently viscous. Neither should we expect such an exudation of fluid rock to be accompanied by mechanical vibrations other than that dependent upon the formation of the fissure, or duct, by which the lava escaped, and which formation would be dependent upon causes extraneous to the actual expulsion of the fluid magma. That such favourable conditions may sometimes occur, so that the actual dyke may traverse strata that are not water-logged, we cannot deny, and possibly some of the great basalt plains of America and elsewhere may so have originated; yet, geology teaches us to consider such to be rather the exception than the rule.

Intrusion of Igneous Matter into Dry, or nearly Dry, Rocks, but not reaching the Surface.—Should a fissure opening downward to the volcanic magma be formed by secular cooling or other means, we should expect that it would be simultaneously filled by the oozing in of the igneous magma. This mass of fused silicates, at a very high temperature, will now undergo a series of changes, which we will attempt to trace. The first thing will be the cooling of a layer of the magma, which is in actual contact with the walls of the fissure; and should that substance be in a purely vitreous condition, a pitchstone salband of variable thickness will result. Now, should the conductivity of the surrounding strata be great, or should the temperature of the magma be near solidification point, then that process will continue from the salband inwards through the whole mass, and a blind dyke will result. On the other hand, should the surrounding strata be bad conductors, already heated, and the magma at a very much higher temperature than that of its solidification, so that its heat might be given out quicker than the surrounding rocks could absorb, any salband that might at first have been formed would be refused, and such re-fusion might extend some distance into the surrounding rocks, continuing to do so until the supply of heat of the injected material was exhausted. Should the surrounding rocks be infusible, a chemical interchange would take place between the igneous and solid matter, resulting in the metamorphism of the former, and a corresponding change in the latter. Although I am not personally acquainted with many examples in illustration of this condition, probably

some of those dykes which are so abundant in the Western Isles and Highlands of Scotland, described by Jameson and others who have followed him, will serve. If the intrusion of the igneous magma takes place in solid rocks, which themselves are at a high temperature from pressure, crushing or conduction of heat upwards from below—three things will probably result. First, the magma, from the small absorption of its heat by the surrounding rocks, would require a very long time to cool, and that would also occur in a very gradual and uniform manner, so that an extremely coarse crystalline structure would result. This is the case in a great number of pegmatite granite veins. Secondly, no salband will be formed, and partial fusion of the fissure walls may occur, so that in gneissose rocks the line of demarcation between them and the intrusive granite, or syenite, may be very ill-defined. Thirdly, the condition will be highly favourable to contact metamorphism, which, in such cases, often extends into the surrounding rocks for very considerable distances, often many hundreds, or even thousands, of yards. (1) Jukes maintained that the granite forms the basis of many volcanoes, being the source of the eruptive matter. It has been observed by Cotta, that the smaller the dyke the smaller the grain, (2) which is explained by the more rapid cooling of the smaller mass. I have seen many examples illustrating this point in the Tyrol. We have the same in nearly all kinds of dykes, where the nearer we approach the outer surface the finer the grain; though volcanic dykes in cones are an exception for some minerals. Negri and Spreafico, in describing an expansion of porphyry near Lugano, show that the felspars near the surface are invisible, so that the rock is a euristic porphyry. Towards the centre of this great mass the crystals are distinct, but round and imperfectly formed, whilst in the dyke, which supplies this great mass, the crystals are very perfect and large, often reaching three centimeters in diameter. We see, therefore, that the perfection of crystallization, and the type of resulting rock, are in direct relation with the length of time and quietness of the cooling of the magma. In the same way we may explain the crystals in the

(1) *L. Gatta, Vulcanismo, 1885, p. 28.*

(2) *Naumann, Lehrbuch der Geologie, 1858-1868.*

salbands of some dykes, being smaller than those in the more central part.

On the other hand, we may meet with various intrusive rocks with more or less purely vitreous salbands, in which, in many cases, the line of demarcation is often distinct and very sharp between the dyke walls and the intrusive matter. There are also cases, as in the dykes of liparite of the Ponza isles, which possess thick pitchstone salbands which are soldered to the walls of the quartzose tufas. It would seem that the great resemblance of the two rocks in chemical and mineralogical composition, and therefore the small difference between their points of fusibility, a very slight excess of temperature in the intrusive rock would be sufficient to fuse the walls, and yet cool rapidly enough to prevent complete crystallization, thus leaving the vitreous salband. This is aided, no doubt, by the low heat conductivity of the surrounding tuffs. Even in granite, although there is no vitreous salband which would be incompatible with its coarse, well-crystallized structure, Naumann describes granite dykes in which the grain is finer towards the margin.

It seems probable that where intrusion takes place into rocks, the cleavage planes of which are nearer the horizontal in direction, the loss of heat will take place slowly, and we should expect to find coarse-grained granites and trap rocks; whereas, the more the cleavage planes approach the vertical the greater will be the rapidity of cooling. This is a question well worth inquiring into, for Jannettaz (1) has shown that the major axis of the isothermic ellipsoid in crystals is parallel to the principal planes of cleavage, and in rocks with the planes of schistosity. (2)

(to be continued)

(1) *Memoires sur la propagation de la chaleur dans les corps cristallisés* (Ann. Ch. et Ph., 4^e serie, t. XXIX., p. 5; Bull de la société Géologique de France, 3^e serie, t. 1^{er} et suiv.)

(2) *As the stratification of strata in general approaches nearer to the horizontal than the vertical, the conditions will be most favourable for the retention of the internal heat of our globe.*

Subterranean Waters in the Sahara.

The admirable results which have attended the artesian borings in the Wed Rir, at Wargla, and more recently at El Golea in the Sahara, have led to a demand being made by the inhabitants of the Mزاب in the southern part of the French Sahara, for the assistance of the Government in undertaking experimental borings in that region also. M. G. Rolland, one of the few geologists who have explored the Algerian Sahara, and the only one who has visited the extreme south, makes the following observations on the régime of subterranean waters between Laghuat and El Golea. From the north to south in the region of the Laya, and on the chalk plateau which extends to the south, borings have no chance of success. In the shebka of the Mزاب and of Metlili, the conditions are only moderately favourable, and it would be necessary to penetrate down to 700 and even to 1000 feet. To the south of the 32nd parallel the chances of success increase in what M. Rolland calls the shebka of the south of El Hassi. Borings would undoubtedly succeed in the depressions of Dayet Tarfa, El Aref, Zubia, and Bn Fakrun. Further south, springing water would be obtained along the western border of the chalk reliefs, which is unfortunately complicated by the ramifications of the Western Erg, and the depths of the borings would go on decreasing until, on approaching the region of El Golea, it would be necessary to penetrate down only to 400 feet.

The Malta Potato Disease.

Productive as is the soil of the Maltese Islands the advantages that it offers to its cultivators are often more than counter-balanced by the destructive attacks of the numerous animal and vegetable parasitical pests with which the produce is from time to time assailed.

As an example of the uncertainty attendant on the efforts of the Maltese agriculturist, we may state that in the early part of the Spring of the present year, the potato crop was especially abundant, and husbandman and merchant alike looked forward to some compensation for the numerous

losses that they had sustained during the preceding seasons. No time was lost in sowing the second crop, but from information that we have received from different parts of the country we learn that the produce has been a total failure owing to the wholesale attacks of the cryptogam. *Phytophthora infestans* which have so impoverished the potatoes, as not only to retard their growth, but also to cause the plant to rapidly die off and rot away.

The disease usually attacks the foliage first, which it causes to rot away rapidly and the leaves become covered with brown spots, which show a whitish, shiny, downy border.

In warm, damp weather the fungus quickly spreads; the spots turn brown, the leaf becomes flabby and decomposition rapidly sets in.

The tuber itself is also often attacked.

It remains hard, but shows a number of brown spots; and when cooked it has a very disagreeable taste.

The disease seems to predominate in the eastern parts of the island, especially in those localities where the phosphate beds of the Globigerina Limestone *do not* crop out. In the valleys, and towards the plateaux in the west where the hill and valley sections expose the phosphate seams the attacks of the fungus have been comparatively slight, and in some localities, quite unknown. This I believe is attributable to the fact that the potato belongs to that class of vegetable life which depends very largely on phosphates for their sustenance, and therefore, where the soil is deficient in these, the impoverishment of the plant pre-disposes it to the attacks of diseases such as that which we are now considering.

Several methods to prevent the spread of the disease have been tried, of which the following may be recommended as being the simplest, *cheapest*, and most *efficacious*.

The soil, and the leaves of the young plant were sprinkled with a mixture consisting of

Sulphate of iron	1 oz.
Water	4 gallons.

the effect of which was to protect the plants so effectually that not a single leaf so treated showed any sign of the fungus.

This mixture not only protects the plant by destroying the fungus spores in the soil, or preventing their propagation, but it also invigorates it, and there is no doubt but that if adopted on a large scale it would be attended with the most beneficial results, and would do much towards eradicating one of the most pernicious pests that the Maltese agriculturist has to contend with.

J. H. C.

On the Meadow of Nysa in Asia Minor

BY

Capt. R. MOORE, R.N. (1)

Any researches which throw light on the topography, history, or archaeology of so interesting and so imperfectly explored a land as Asia Minor, appear to me worthy of record, and I therefore venture to give a brief account of an excursion I made some years since to the ancient city of Nysa and its neighbourhood.

Nysa was a Greek city situated on the north side of the Meander valley, and on the lower slopes of the Messogis range, occupying a highly picturesque position and retaining many remains to attest its ancient magnificence. It is now easy of access by means of the Ottoman Railway, which in 1881 was extended to Nazli, for it lies within two miles from the station of Sultan Hissar. The site has rarely been visited by travellers and more rarely described. Chandler visited it in 1765; Fellows in 1840; but, since the publication of his second tour, I am not aware that it has been described by any traveller. Texier's account of it is a compilation; he had not visited the site. Neither Arindell nor Van Lannep, the most recent travellers in Asia Minor, visited it. The earliest description, and perhaps the best we have of it, is that of Strabo (XIV, I, 43-46), who tells us it rested against the Messogis, and was intersected by a mountain torrent which divided it into two parts, so as to make it appear a double city. "In one part (he tells us) the chasm is spanned by a bridge; in another the city is adorned

(1) Read before the Archaeological Society of Rome.

with an amphitheatre, beneath which is a subterranean channel for the torrent. Near the theatre are two heights; beneath one stood the gymnasium for youths, and below the other the *agora* and the *geronticon* or the gymnasium for elder men. Below the city to the South stretches the plain of the Meander, just as at Tralles." Strabo then describes the country between Tralles and Nysa. Chandler was led to suppose that the portion of the town to the West was Nysa; that to the East Tralles, but the passage of Strabo which follows his description should have shown him his error. There is indeed much similarity in the position of the two cities, but they lie 18 miles or more apart.

I visited Nysa under favourable auspices, in the company of Mr. Edward Purser, the Manager of the Ottoman railway, and of Mr. W. M. Ramsay, whose explorations in Asia Minor have given him a European reputation. Our object was not so much to explore the remains of Nysa, which we left for a future occasion, as to discover a certain spot in its neighbourhood mentioned by Strabo, the position of which had not been ascertained. I shall therefore say no more of Nysa, than that we verified the accuracy of Strabo's description of the peculiar features of its situation, and the position of the buildings he specifies, and enjoyed the magnificent view of the Meander valley and its enclosing mountains from the upper seats of the Greek theatre.

The old geographer writes: "Thirty stadia from Nysa, as you cross the Messogis towards the southern parts of the Tmolus-mountain, lies a spot called the Meadow to which the Nysæans and all their neighbours resort in procession to celebrate their festivals. Not far from this is a cave, sacred to the deities (Hades and Cora), which cave is said to run underground as far as the land of the *Acharacans*. This is the meadow, they say, mentioned by the poet when he speaks of the Asian meadow, and they point out the *heroum* of Caystrius and of a certain *Asias*, and the Cayster flowing around it" (Iliad II, 44).

Chandler thought he had found this meadow on the road between Nysa and Nazli, in "a remarkable gap in the range of Messogis, opening a view into a green plain at some distance on our left." But his green plain could not have been the

Nysæan meadow, for it lies on the Meander side of the range. This passage in Strabo, however, is confessedly corrupt; the words are differently arranged in the several editions of the author, yet the true meaning is generally admitted to be this—that to reach the meadow you must cross the Messogis range in a northerly direction, and you will then come to a piece of level ground, commanding a view over the valley of the Cayster and the southern slopes of the great chain of Tmolus. The position of the meadow then is unquestionable connected with the Cayster valley and the Tmolus range beyond it.

Our expedition was projected by Mr. Purser, who having heard of a grassy plain on the further side of the Messogis range, which seemed to answer to Strabo's description, though at a much greater distance from Nysa than the 30 stadia given in his text, resolved to verify the statement, and kindly invited Mr. Ramsay and myself to bear him company.

On leaving the ruins of Nysa, we retraced our steps through shady lanes towards the station of Sultan Hissar, when, skirting the base of the plateau of the ancient city to the East, we turned to the North and pursued that direction for the rest of our journey. We traversed a valley well cultivated with vines, corn, olive and fig-trees, yet without any signs of habitation. But I was reminded that in Roman times the wines grown on the mountain above Nysa were esteemed the best the Messogis produced (Strabo, XIV, I, 47). The valley gradually contracted, being hemmed in by cliffs, which in one spot were yellow with sulphur, till it shrunk to a narrow, deep ravine with slopes darkened by olive groves. These slopes, after a tedious ascent, led us to the village of Malagatch, some $2\frac{1}{2}$ hours from Sultan-Hissar. This village, which takes its name "Tree of the Treasure" from having been the deposit of the spoils of brigandage, hangs on both sides of the ravine, or *Déré*, through which flowed the torrent which we were to trace on the morrow to its source. It was very unlike a European village; it had no street, not even a mosque. The houses (many were mere sheds of mud and wood without windows) were scattered at random on the steep slopes, under venerable olive-trees. Here in the best house in the village, the only one possessing

an upper storey, we passed the night, meeting with a rude but hearty hospitality, our host resigning his own bedroom to his guests and providing them with mattresses and coverlids.

The interest of the place lay in the fact that it had long been a brigand's hold. Our host Kara Ali, or Black Ali, had been the chief of the band, but, with his comrade Babà, had recently made his peace with the Government, and both of them now served as guards on the Ottoman Railway. All the villagers were Zeybecs, and had belonged to the robber-band, and the chiefs still retained their sway throughout this district; their pass, I was told, being still respected far and wide throughout the range of the Messogis. The Zeybecs are probably the descendants of one of the aboriginal tribes of Anatolia, who have been driven to the mountains; where they practise their profession of robbers, acknowledging no law but their own will; and, like the Arabs, are generally at war with all civilized mankind. They speak Turkish and profess to be Mussulmans, but hold their religion somewhat loosely, in which particular they differ from the Turkish peasantry, who are strict observers of their religious duties, and from whom they are at once distinguishable by their costume. I had heard that Franks were never allowed to enter a Zeybec village, except as hostages for their ransom; and we were informed that we were the first Europeans who had visited the village of Malagatchi.

But how, to use the phraseology of the Koran, shall I cause you to understand what a Zeybec is like?

(to be continued)

Vanishing Forms.

In an account of the vertebrates which have recently become extinct or are likely soon to become so, Mr. A. F. Lucas mentions the following: The West Indian Seal (*Monachus tropicalis*), of which little is known. The California Sea-Elephant (*Macrohinus angustirostris*), last reported in 1884. The Walruses, the species of the Pacific (*Odobœenus obesus*) being in greater danger from whalers than that of the Atlantic (*O. Rosmarus*).

The European Bison (*Bison bonasus*), at present diminishing in numbers although protected in the two localities where it exists. Most of the native birds of the Hawaiian Islands, three species having already disappeared—one of them through the demand for war feathers for the native kings. The California Vulture (*Pseudogryphus californianus*), now extremely rare. The Dodo (*Didus ineptus*) of Mauritius and the Solitaire (*Pezophaps solitaria*) of Rodriguez, whose existing remains consist of a few bones. The Labrador Duck (*Camptolaemus labradorius*), of which 36 specimens have been preserved, the last taken in 1878. The Great Auk, (*Alca impennis*), exterminated in 1840, though specimens are less rare than those of the Labrador duck, while commanding such prices as \$ 600 for a single skeleton, \$ 650 for a skin, and \$ 1500 for an egg. Pallas' Cormorant (*Phalacrocorax perspicillatus*), abundant on Behring Island in 1741, but extinct a hundred years later, and now known only by 4 stuffed specimens and 23 bones in the museums of the world. The great Galapagos and Mascarene tortoises, once very abundant, but the latter extinct early in this century. The Tile Fish (*Lopholatilus chamaeleonticeps*), with one of the strangest histories known. It was first discovered in March, 1879, when a Gloucester schooner took about 6000 pounds; in 1880 and 1881 a few were taken by the steamer of the U. S. Fish Commission; in March and April, 1882, an immense number of the dead fish—estimated at more than a billion—were observed floating over an area of 5000 to 7000 square miles; and no specimen has been reported since.

Algerian Oases.

Since the the French occupation of Tunis and Algeria some wonderful improvements have been made in what was prior to their advent among the most sterile regions in the face of the globe. By means of their so called system of *colonisation saharienne*, the Algerian Sabara which was formerly nothing but sand is now rapidly being transformed by the aid of artesian wells into the most luxuriant gardens. As one example of the wonderful changes they have wrought we may note the district of Biskra, called the Waddy R'hir.

This region formerly had an evil reputation for sterility and aridity. It now has forty-three oases scattered over it, containing 520,000 palm trees and 100,000 fruit trees. The dates produced there are of a very superior quality, almost as delicious as those of the Tunisian Belud-el Djerid, and their value is estimated at the rate of 35 per kilo (about 1½d per pound), or 2½ million francs per annum, which are, to a large extent, sent to France by parcel post.

Below the whole valley of Waddy R'hir and for some hundreds of miles to the south of it, alongside the immensely wide bed of the so-called "stream" (Arabic, *Iqarghar*), a subterranean current of water runs, only requiring to be reached by boring, and thus opening up the glorious perspective of a vast extension of this colonisation. It has been said that the date is for the desert what cereals are for Europe, and what rice is for India and China, and what maize is for America. It is for the inhabitants their chief food, their most certain product, the prime object of consumption and exchange. Dates alone, however, are not sufficiently nutritive, hence the cultivator's need of exchanging cereals.

Prehistoric Man in the Mediterranean.

The recent further discovery of prehistoric human remains in one of the caves near Mentone has agitated the scientific world in France and elsewhere.

As described in a previous article, they point to a race of a very degraded type, evidently of the palæolithic period, or before the age of metals. A correspondent, says the *GLOBE*, has just had an interview with M. Bonfils, the intelligent curator of the Mentone Museum, who is ready on all occasions to impart his views on the subject of these wonderful discoveries.

M. Bonfils has been associated from the very beginning with the researches in this locality, dating back some thirty years, and his opinions, therefore, are of the greatest value. He admits, that to fix the exact date when these human beings existed is practically impossible. Savants in France are not all so modest in their

views. One, in particular, whose name is well known in the scientific world, lays down the law absolutely that all remains found of the palæolithic period must be quite a hundred thousand years old! Those of the neolithic he calculates to be fifty thousand years, and so on to a paltry ten thousand, after which the days of the Pharos, and certainly those of the Romans, seem scarcely worth anything. M. Bonfils is disposed to think that all these calculations are based on insufficient data, although he is not at all sure that they are in any way exaggerated.

What is certain is that the existence of these cave-men must have been at an extremely remote period, and that, from the formation of their skulls, they were of a decidedly degraded and animal nature. Four out of the five principal caves have, from time to time, been thoroughly examined, as may be seen by the specimens in the museum, both human and animal.

The fifth cave is virtually intact, and will, no doubt, at some future time be thoroughly explored, and with the experience gained in the past, with, probably, still more satisfactory results.

Our correspondent mentions one fact in connection with M. Bonfils which will exemplify his practical character and the way in which he has set to work to prove some of his views. M. Bonfils stated that on many occasions he had overheard visitors pointing to various stone implements and asserting that, according to certain savants, they must have taken years of patient toil to make, and probably had been handed down from father to son before they were completed. M. Bonfils, to prove the fallacy of this theory, proceeded to place himself exactly in the position, of one of these prehistoric aborigines, and without any tools except those provided by nature succeeded in making replicas of every conceivable flint and bone weapon or implement which has ever been discovered. To be quite fair, he has not allowed himself even a chair to sit on, or a pair of spectacles to protect his eyes when at work and when the particles of flint have been flying about his face. He has received many a wound, but nothing of a serious character, and the results of his labour are full of interest. His hardest work seems to have been to pierce the holes for his hammer heads to receive their handles when made

of the toughest flint. He has also made harpoons and spear heads of the bones of animals, and even fish hooks from oyster shells; and all this, as has been stated, with nothing but the flint tools which he has made himself, and in exact imitation of those which have from time to time been discovered. It would be a long task to give a complete list of all the various interesting objects he has made, from sinkers for fishing-lines to elaborate spear heads and axes of various shapes with a wonderfully keen edge. He has made beads out of amber and perforated them, pierced animals teeth of the very hardest enamel for necklaces, and on each article has placed a record of the time it has taken him to make them, varying from many days to a few hours only, thus upsetting the idea that they took very long to complete. The collection is most interesting in every respect, and reflects great credit on the patience of the worker, who is in every respect a worthy searcher after truth, and of great value to the museum of his native town, of which, indeed, he has been to all intents the founder.

One other feature this museum possesses which is due to M. Bonfils and that is a large illustration made by himself of all the nets and engines used by the natives at the present day for the taking of fish in the Mediterranean, which, unfortunately, have been employed so mercilessly in and out of season that the sea is almost fishless—a result which no one regrets more than M. Bonfils, who can hardly speak *on the subject with patience*.

Fossil Birds in Corsica and Sardinia.

*On the Pleistocene Bird-remains from the
Sardinian and Corsican Islands.*

BY R. LYDEKKER B.A., NOV. 1891.

In this little brochure Mr. R. Lydekker gives us the results of his examination of a small collection of bird-remains that was obtained by Prof. C. J. Forysth-Major of Florence from a cave deposit in Tavolara near Sardinia, and from the ossiferous breccias found in Sardinia and Corsica. The author notes that fossil bird remains were found in

these areas as far back as 1832 by Rudolf Wagner, but that no attempt seems to have been made to determine any of them specifically, and in many cases even the generic position assigned to them was doubtful.

Of the remains discovered by Prof. Forysth-Major the majority belong to a number of extinct species of bubos, eagles, vultures, rollers, puffins, quails, pigeons, swallows, larks, finches, and crows. This fact he considers to be of much importance for it has been already shown by Dr. Adams and Dr. Falcner that the extinct mammalia discovered in Sicily, Malta, and Crete have a distinctly African facies and that as the number of extinct species found in them is proportionately large he thinks that further researches may reveal evidences of similar African affinities in Corsica & Sardinia.

The discovery of these birds will not at present admit of a comparison being made, owing to their migratory habits; but the presence of an African species of *Bubo* and also of a *Roller* serve to indicate the nature of the results that we may expect to obtain when further researches have been made. It has not been possible to come to any definite conclusions regarding all of the extinct species, owing, the author observes, to the imperfection of the English collection of recent avians skeletons; but in those cases where distinctions have been made they have been based on well marked differences between the fossil and the existing form. The most abundant of the fossil forms found in the Tavolara cave belonged to Shear-waters, Quails, Crows, and Swallows.

The following is a list of the remains that have been determined, a detailed description of which occupies the greater part of the brochure.

STRIGES—*Bubo cf. cinerascens Guerin*

ACCIPITRES—*Milvus, cf. ietinus Savigni*. *Aquila* sp. *Vultur cf. monachus Linn.*

PICARÆ—*Coracias cf. abyssinica Bodd.*

PASSERES—*Corvus corone Linn.* *Fringillidæ* (sev. sp.) *Alaudidæ* (sev. sp.) *Sylviidæ* (?). *Turdidæ*. *Hirundinidæ*.

COLUMBÆ—*Columba, cf. livia, Linn.*

GALLINÆ—*Coturnix communis Bonnaterra.*

TURBINARES—*Procellaria* (sev. sp.)

NOTES AND NEWS.

DISCOVERY OF SALT IN EGYPT.—*Industries* reports that a discovery of salt, which seems likely to have important consequences, has been made by the officers of the Egyptian Salt Department, 25 miles west of Minieh, a point on the Nile about 150 miles above Cairo. The salt is said to be of good quality, and the deposit to extend over an area of 1,000 acres.

HUMANITY'S FUTURE ON EARTH.—The passing away of the human race is made certain by the signs of the sun's approaching extinction. Referring to Prof. Langley's researches on the loss of solar heat, Sir Robert Ball says that the greatest amount of heat the sun can ever have contained would supply its radiation for 18,000,000 years at the present rate. It seems that the sun has already dissipated about four-fifths of its original energy, and that it may hold out for 4,000,000 or 5,000,000 years more, but not for 10,000,000 years. No possible source of heat seems to be available for replenishing the waning stores. The heat may have been originally imparted to the sun as the result of some great collision between two bodies which were both dark before, so that, in fact, the two dark bodies coalesced into a vast nebula from which the whole of our system was evolved. That the sun may be reinvigorated by a repetition of a similar startling process is, of course, always conceivable, but so terrific a convulsion would be fatal to all life in the solar system. From no source does it seem possible to discover any rescue from the inevitable end. The race is as mortal as the individual.

IRRIGATION IN EGYPT.—At the date of a recent official report, according to *Engineering*, Egypt had 565,744 acres of irrigated land under cultivation, or about 8,840 square miles. The irrigated lands extend along the Nile for a distance of 525

miles. The revenue derived by the Egyptian government in 1890 from water tax and rented lands was £5,084,547. The population of the irrigated districts is returned as 5,879,431.

IMITATIVE FORMS IN ROCKS.—There is a universal tendency to seek, and sometimes to see, in the forms of objects around us representations of the human figure or of animals and plants, says M. Stanislas Meunier in *Popular Science Monthly* for May. Many interesting examples have been recorded and pictured in *La Nature* of rocks and mountains presenting resemblances to animated forms. We are quite ready to discern in the clouds all sorts of personages; and at periods when superstition has been active, apparitions have been described, the whole existence of which consisted of misinterpreted simple resemblances. Stones have usually been considered especially worthy of attention in this category; in tubercles of sandstone and nodules of flint it is easy to find features analogous with the most various objects. A block of sandstone is exhibited in the forest of Fontainebleau on which one willing to see it may recognize a petrified knight on his horse, all of the natural size. A nodule of sandstone was once brought to the geological laboratory of the museum, on which the owner saw the portrait of our Lord on the cross. Some persons are specially ingenious in finding resemblances in flints; and Boucher de Perthes admitted into his *Atlas of Celtic and Antediluvian Antiquities* a whole series of figures of imitative forms of that mineral.

AN UNCANNY CUSTOMER. — In bygone times the waters of the Mediterranean have served as the habitat of some curious monsters of which the carnivorous whale *Zeuglodon* and the enormous shark *Carcharodon megalodon* were perhaps the most formidable. But though these are now extinct their places are filled by monsters almost equally as large and in some respects equally

as ferocious; of these the devil fish which has been named by Risso, *Cephaloptera Massena* is one remarkable instance of the numerous leviathans which make this inland sea their home in common with the Atlantic and the Indian Oceans. It is a species of monstrous, hideous ray of enormous dimensions and of extraordinary muscular power, with a huge mouth and stomach situated in the front of a massive, shapeless head.

It is occasionally caught by Mediterranean fishermen, and is naturally held by them in great awe and dread.

Se Vaillant, the African traveller, records the capture of a specimen that measured 25 feet long, and thirty feet wide from fin to fin; and Risso described the capture of two specimens at Nice one of which weighed 1328 pounds, and the other 885 pounds.

MALTA'S SPRING VISITORS.—The near approach of summer has already been heralded by the usual flocks of our Spring feathered visitors. During the last month the valleys and gorges have been alive with Orioles, Warblers, Rollers, and Bee-eaters. In the rich crimson clover enormous numbers of Quails have found shelter during the brief sojourn that they make on these shores *en route* for the continent, while the branches and foliage of the Carob, the Prickly Pear, and the Orange trees have been thronged with Harriers and Larks.

CLIMATE OF THE SAHARA.—Between the climate of the Sahara and that of the other Mediterranean regions surrounding it there are many and striking differences.

In the latter places periodical rains divide the year into two seasons, but in the Sahara years sometimes elapse without a single shower.

Dew is unknown and even the Scirocco which is noted all over the Mediterranean and Southern Europe for its humid condition is there robbed of its moisture by the enormous parched tracts of country over

which it blows. The careful observations of these and other physical facts connected with this district are inclining geographers to the belief that the causes to which the Sahara owes its existence are of a meteorological rather than of a geological character.

EARTHQUAKES AND PLANT-GROWTH.—

The effects of earthquakes upon vegetation have been studied in northern Italy by Signor A. Goiran. He finds that the disturbances of last June were generally followed by a more rapid germination of seeds, and a more rapid growth of the young plants, giving a more luxuriant vegetation in pastures, fields, vineyards, and shrubberies, with an unusually deep green color of the leaves. He does not trace these results directly to the tremor, but to three secondary causes—an increased production of carbonic acid, a diffusion of fertilizing fluids through the soil, and an increased production of electricity. Some other earthquakes seem to have unfavorably affected vegetation, but they were associated with long periods of drought.

FERTILITY OF THE SAHARA.—The most fertile portion of Algeria is that known as the Tell. It comprises a tract of arable country, hilly, beautifully wooded, and very fertile having an average breadth of forty-five miles and extending from the Mediterranean to the foot of the mid-Algerian mountain range.

The arbutis, myrtle, lentisk, tree-heath, and cistus are especially common; but the number and variety of the trees and plants is very great amounting in all to about 3000 the majority of which are also indigenous to Southern Europe.

A NOVEL INDUSTRY.—The late Rev. H. Seddall who was for many years a resident of Malta when referring to the shell-fish of the Maltese Islands speaks of a very curious form of industry that was formerly practised by the Maltese, "Five species of

Pinna are found in Malta, some of them common in the harbours within reach of a boat or a pole hook. They project from the mud amongst the *Zostera* roots to which they are attached by their silken cable. Of this silk, which is of fine texture, but heavy, *I have seen gloves made.*"

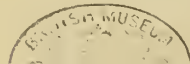
STREET MICROBES. — The dust of the streets of Naples has been the subject of an elaborate investigation by Dr. Luigi Manfredi, who reveals startling possibilities of evil. The microbes of all kinds found in the dust averaged 761,521,000 per gramme, though in the cleanest and least travelled streets the average number was only 10,000,000 per gramme, while in the busiest thoroughfares it rose to 1,000,000,000, and in some of the dirtiest streets to the enormous figure of 5,000,000,000 per gramme. Many of these organisms were those of disease, and the unhealthiness of the street or quarter was directly proportional to the number of microbes in the dust. The infective power of the dust was tested, with positive results in 73 per cent of the experiments, suppuration, tetanus, tuberculosis, blood-poisoning, etc., being produced in dust-inoculated guinea pigs.

We have pleasure in acknowledging the receipt of the third and fourth numbers of *Natural Science*, the new monthly review to which we called the attention of our readers in December last. Such an excellent work is deserving of every support. Among the contributors to the above numbers we note the names of Prof. G. Heuslow, Sir J. W. Dawson, Prof. Williamson, Mr. Lydekker, and other eminent naturalist. Messrs Macmillan & Co., London are the publishers.

A FULLY PEOPLED EARTH. — From a series of researches and calculations by M. Ravenstein, a French geographer, it appears that over-population of the globe and the beginning of human decadence may be nearer at hand than most of us have supposed to be possible. The present popula-

tion, 1,467,000,000 individuals, is distributed over the continents and islands, exclusive of polar regions, in the proportion of 31 inhabitants to the English square mile. Dividing the entire land surface, 46,250,000 square miles, into three regions, this author finds that fertile lands occupy, in round numbers, 28,000,000 square miles, steppes 14,000,000, and deserts 4,000,000. He estimates that the maximum number of persons that can be supported throughout the respective regions is 207 per square mile on the fertile lands, 10 on the steppes, and 1 per square mile on the deserts. The present average for India is 175, for China 295, for Japan 264. The investigator concludes that the greatest number of persons the entire land surface can sustain is 5,994,000,000. The total increase in population is now 8 per cent per decade—being 8, 7 in Europe, 6 in Asia, 10 in Africa, 30 in Australia and Oceanica, 20 in North America, and 15 in South America,—and at this rate the earth will have acquired all the inhabitants it can maintain in about 180 years, or in 2072. Quite curiously, this date is about that fixed by geologists for the exhaustion of Great Britain's coal supply.

Referring to the Tewfikieh College of Agriculture in a lecture on Egyptian agriculture delivered at a meeting of the Society of Arts Prof. R. Wallace tells us that it was so named in honour of the late Khedive (Tewfik Pasha) who contributed much towards its success. It was started about two years ago by the Egyptian Government for the purpose of encouraging scientific agriculture and it commenced with 60 students, who underwent a systematic course of instruction in agriculture in the course of which a knowledge of improved rotations, of improved implements, and improved methods was acquired. The benefit of the institutions is already beginning to be felt in the country districts.



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To Correspondents.

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Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

The recent discovery of skeletons in the caves at Mentone.

By G. H. BRYAN.

Much interest always attaches to discoveries of the remains of prehistoric man, and when it was learnt that, shortly after February 7th., three entire human skeletons had been found interred in the Bone Caves of the Red Rocks near Mentone, the news caused considerable excitement among the residents wintering on the Riviera, and afforded food for much speculative discussion in scientific circles.

As it was my good fortune during a recent visit to the northern shores of the Mediterranean to see these skeletons *in situ* and the various objects found at the same time, I have thought that a short account of them may be of interest.

The Baoussé Roussé (of Mentonasque dialect), Rochers Rouges, or Red Rocks are situated at the eastern end of the East Bay of Mentone just on the Italian side of the frontier. They form a fine projecting cliff of jurassic limestone at the foot of a range of higher hills, and the presence of iron, coupled with the action of the weather, have coloured this rock like many other rocks near Mentone a beautiful orange red. It is thus one of the most striking features of the East Bay, and at its base are the caves which have afforded shelter for countless wild animals and generations of prehistoric man. According to M. Rivière of Paris the number of these caves is five, but M. Bonfils the enthusiastic founder and curator of the Museum at Mentone maintains with a great show of reason that only four of these are genuine caves, and he therefore adopts a different system of numbering the caves. Hence it arises that the cave in which the new skeletons have been found is the fifth according to M. Rivière and the fourth according to M. Bonfils.

It is much to be regretted that during the last 17 years the Red Rocks have been utterly spoilt by quarrying—a piece of vandalism on a par with the similar operations now going on at the Cheddar cliffs in Somersetshire, and one of the many instances of wanton destruction of the beauties in the neighbourhood of Mentone. The picturesque outline of the overhanging brow between the two most eastward caves is now gone and only a huge stone quarry remains in its place, while even the caves have already begun to disappear. The mouth of the last cave but one has now been destroyed, and it was in the course of blasting away a further portion of its side that the present skeletons were accidentally found by the quarryman, a common uneducated labourer.

This discovery raises the total number of human remains found in the caves to five whole skeletons and parts of six others, or eleven in all. The following is a complete list of these remains with the years of their discovery.

1872-73. Complete skeleton of neolithic man discovered by M. Rivière. This is his "Thomnie de Menton" now preserved in the museum at Paris.

Fragments of three human adults of heights 1.85, 1.90 and 2.00 metres respectively.

Fragments of three children. All these were found in the course of a thorough exploration of the caves conducted by M. Rivière.

1884. Perfect skeleton of a man 2.03 metres high discovered by M. Bonfils. This is the "nouvel homme préhistorique de Menton" and M. Bonfils claims that it is palæolithic. The skull which was shattered by the pick of a workman has been pieced together and is now in the Museum of Mentone, but the rest of the bones were stolen by the workmen and have never been recovered.

1892. Three complete skeletons of neolithic man.

According to M. Rivière's report these skeletons were situated at a distance of 18 metres from the mouth of the cave, but as the latter has been destroyed the figures are not reliable. Rivière estimates the depth of the cave at its narrowest point as $31\frac{1}{2}$ metres.

At the time of my visit (April 11,) the skeletons were still *in situ* with no protection but a few planks thrown over them, and as it was more than

two months since they were first unearthed, the bones must have suffered much damage from exposure to the air.

The skulls, which were accidentally broken at the time of discovery, had been removed and pieced together, and they, together with the ornaments, were exhibited by the quarryman at a small tavern close by. The orientation of the bodies was east to west, all the skeletons previously discovered having been found pointing north to south. All three were lying on their left sides with their legs crossed, the middle one lying at a slightly lower level than the first and third. Of the latter one was an old man, the other being a lad about twenty years old as might be seen from his wisdom teeth not being fully cut. The middle skeleton was supposed to be a woman, but had not been so critically examined owing to its greater depth.

The heights of the three have been variously estimated. In a leading article which appeared in the *Standard* just after our visit, the old man was stated to be 8 feet (2.42 metres) and the woman 6 feet 3 inches high (1.89 metres). On the other hand M. Rivière estimates the longest—the old man—at 2.05 metres and the next at about 1.85 metres. But from their lengths from head to foot in their recumbent positions it would be difficult to estimate what they would stretch to when fully extended. Probably the largest one was about 2.12 metres high.

The skulls are of a remarkable oblong shape showing that these cave dwellers belonged to a *dolichocephalic* or long skulled race. The teeth are notable for their perfect state of preservation.

Two of the skeletons had the left arms raised and the skulls rested on large flint scrapers held in the left hands. The right arms, which were of course uppermost, were allowed to drop freely at the sides. The other skeleton was found with its left arm extended and also holding a flint knife or scraper. The largest scraper was that found undermost the skull of the old man. According to report, it measured 26 centimetres long by 5 broad. All the bones were coloured dull red with bright spots of oligistic iron which evidently served to cover up the bodies at the time of interment; possibly the use of this iron formed a part of the funeral rites. The remains were concealed by an

overhanging ledge of rock and were exposed on the destruction of this rock.

A great many other interesting objects were found along with the skeletons. Each of them had a necklace round the neck. One of these was formed of the shells of a species of *Nassa*, another consisted of the canine teeth of a kind of stag drilled with holes and strung together, while the third was made out of vertebræ of a fish of the genus *Salmo*. Both the teeth and the vertebræ were of the same brick-red colour as the bones.

On the legs were found two cowrie shells (*Cypræa*) one being placed just above the instep. But perhaps the most remarkable objects of all were some hour-glass shaped bodies fashioned out of stags' horn. Perhaps their form might be more accurately likened to two eggs cemented together by their ends. The length of one of these objects has been stated by M. Rivière in his report as 39.6 centimetres but this is certainly a gross exaggeration, possibly 3.96 centimetres was intended. Their surfaces were engraved with fine parallel nearly equidistant grooves or scratches running longitudinally from end to end. I have heard no suggestion as to the use of these objects.

The present remains undoubtedly belong to the neolithic or later stone ages as the flints and ornaments abundantly testify. Whether M. Bonfils is justified in his surmise that the "nouvel homme" of 1884 belonged to the palæolithic era is a matter which we cannot discuss here. It was certainly found at a much greater depth than any of the others. Small flint implements are found distributed throughout the soil forming the floor of the caves in such abundance that M. Bonfils has built a trophy of them to commemorate the visit of the French Association for the Advancement of Science to his museum.

Shortly after our visit the cave was closed and the skeletons were removed pending a lawsuit in which they literally became a bone of contention, the quarryman, M. Rivière, the Prince of Monaco and the Italian Government all laying claim to the "treasure trove." It is to be hoped that the proceedings will result in a thorough and searching exploration of the caves, and that, should any further remains be found, they will not be at the mercy of unintelligent quarrymen but will be carefully tended and preserved.

The Phosphate Beds of the Maltese Islands and their possibilities

BY JOHN H. COOKE, F. G. S.

The recent discovery of phosphate beds that has been made in the Maltese Islands has been attracting considerable attention, in both scientific and commercial circles, and since a general sketch only of the beds has yet been published, the following details bearing on the subject may not be without some interest to those who are connected with the phosphate industry in other parts of the globe.

The Maltese group, consisting of the islands of Malta, Gozo and Comino, and of of several smaller islets is situated in the Central Mediterranean at a distance of 60 miles to the north of Cape Calipia the nearest point in Africa.

On the north it is connected with Sicily by means of a sub-aqueous plateau, the depth of submergence of which does not exceed 70 fathoms in any part; while to the south a deep channel having an average depth of 530 fathoms, and which is 190 miles long and from 60 to 600 miles wide forms a well defined natural boundary between it and Africa.

Malta is the principal island of the group both in size and commercial importance, its area being 95 square miles while that of Gozo is but 21 square miles. Gozo is, however, more fertile, a fact that it is attributable to the greater diversity that exists in its surface contour whereby the numerous phosphatic nodule seams that are interstratified with its rocks, are exposed along the slopes of most of the hills and valleys throughout the island.

The soil is thus kept in a high state of fertility, for, as it is indigenous to the islands and is still being added to by the degradation of the rocks around, the phosphate of lime which is found in comparatively high proportions in many parts of the beds is constantly being incorporated with it.

The topographical aspect of Gozo and of the western half of Malta is that of a series of plateaux, and flat topped conical hills that rise to an average height of 550 feet above the sea level, and that expose around their sides either clean cut vertical sections, or softly rounded taluses of their various strata.

The valleys that divide these uplands generally run in a direction that is parallel to the principal faults of the locality, and most of them divide the plateaux into a series of spurs that abut on the low-lying plains on the north and east. Along all of these spurs three or more of the seams crop out, so that they serve as constant feeders to the soil in the plains beneath.

A considerable difference of opinion has been expressed as to what period of geologic time the strata of the Maltese Islands should be referred.

The late Admiral Spratt, Prof. L. Adams, Prof. T. R. Jones, as well as many other eminent Mediterranean geologists were divided as to whether they should be considered as being of Eocene or of Miocene age. Latterly, the subject has received most careful attention at the hands of Prof. Thos. Fuchs, the Vienna geologist Dr. John Murray, and Mr. J. W. Gregory, F.G.S. and from the consideration of the lithological and paleontological characters of the rocks, and a comparison with their continental analogues, it has been concluded that the lower half is certainly of Oligocene Age, and most probably Tongrian, whereas the upper half, in which the phosphate seams occur, is certainly Miocene and finds its equivalent in the rocks of the Vienna Basin.

The following table will best illustrate the order in which the Maltese beds occur, and the relation that they bear to the Austrian series.

All of the beds preserve the same relative position in every part of the group, and as they are all more or less horizontal, their geological structure is of a very simple character. In the eastern half of Malta, beds I, II, and III are missing, having probably been swept away by one of the many oscillations of level which occurred in pre-historic times when the connection between the continents of Europe and Africa, via Malta, was severed; but in the western portions, though faults are more numerous, the physical and stratigraphical features of the series more nearly approximate to those that characterize the Gozitan beds.

The five formations which constitute the Maltese series, vary lithologically and chemically, but as it does not lie within the scope of this article to discuss the differences in detail, I shall limit my remarks to pointing out those only that have a direct bearing upon the subject which I am now treating.

From the following table, which has been compiled from analyses made by Dr. John Murray, Prof. J. Blake, and myself, it will be seen that all of the beds contain phosphoric acid combined with calcium in a greater or a lesser degree.

Bed I. Upper Coralline Limestone contains traces to 2 % of P₂O₅

Bed II. Greensands contains traces to 6 %.

„ III. Blue Clay traces only.

THE MALTESE ISLANDS.				Vienna Basin	Series	
No.	Formation.	Thickness.	Sub-division.			
I	Upper Coralline Limestone.	250 ft.	{ a. Compact, white, limestone of a breccia like texture. b. Soft, porous, red limestone.	Leithakalk	Tortonian	Miocene
II	Greensands	50 ft.	{ a. Compact, yellow sandstone. b. Friable, black sandstone.	Grund.	Helvetian	
III	Blue Clay	30 ft.	{ a. Yellow clay. b. Blue clay.	Schichten. Schlier	Langhian	
IV	Globigerina Limestone	200 ft.	Variously coloured bed interstratified with from three to six nodule seams.	Horner Sotzka Schichten.		
V	Lower Coralline Limestone.	250 ft.	{ a. Semicrystalline limestone. b. Non crystalline limestone.		Aquitanian	Oligocene

- „ IV. Glob. Limestone { a. Limestone 2 % to 3 %.
b. Nodules 10 % to 18 %.

„ V. Lower Cor. Limestone, traces

In the Greensands and the Globigerina Limestone, the highest percentages were found in the black or chocolate coloured nodules that were interspersed through the beds. These nodules occur very irregularly and in but small quantities in the former, so that, from a commercial point of view, the formation needs no further consideration. In the latter, they are found in great abundance, occurring in well defined layers that are both uniform in their thickness and unvariable in their distribution. As it is, therefore, with the Globigerina rock that we shall have to deal, a few details relative to its principal characteristics will be necessary before proceeding to consider the phosphate beds that lie interstratified with it.

This formation, as the section (fig. 1.) shows, extends throughout the length and breadth of both islands, but in the north-western and western parts, it is overlain by the Clays, Greensands, and Upper Coralline Limestone which effectually mask it over a considerable district, but its outcrops along the valleys and in the eastern parts of Malta extend over an area that is equal to about two-thirds of the total extent of the island.

Between the Great Fault and Marsa Scirocco, an area of about 50 square miles has been planed down to such an extent as to remove from it a capping of deposits that had an average thickness of 350 feet. The surface contour of this district is therefore very irregular, and as the Globigerina itself has in many cases been also subjected to considerable erosion, the upper phosphate seams

contained in it have been left exposed as the surface layer.

In Gozo the denudation of this formation has not been so extensive, and therefore it exhibits a more uniform thickness in that island than it does in Malta, and appears as the surface deposit over an area equal to about one fifth of the total area of the island, the greater part of which is found in the bottom of the valleys, and at the bases of the hills.

Proceeding now to consider the various divisions of the formation we find that they consist of at least four varieties of rock each of which varies considerably in its lithological characters, and interstratified with which is a series of seams of phosphatic nodules which is very regular in its distribution.

The following shows the order in which these beds and their intercalated layers of phosphate rock occur.

In Gozo and in the western half of Malta the whole series crops out along every valley and hill side, but where the Globigerina rock itself serves as the surface deposit the intermediate layers of limestone often mask the nodule beds in such a manner as to completely hide from view all evidence of their presence. Where this occurs the soil is usually very poor and unproductive.

The first nodule seam is variable in its nature and thickness in different localities. For example in the southern coast exposures it does not average more than 9 inches in thickness, and the nodules are sparsely distributed; but in the cliff sections in the centre of the island, it has an average thickness of 1 foot 3 inches and the nodules are numerous and compact.

FORMATION	SUBDIVISIONS	THICKNESS
Globigerina Limestone	a. A greyish, fine-grained freestone	15 to 20 ft.
	b. First seam of phosphatic nodules	1 ft.
	c. A white, compact, fine grained free-stone	40 to 50 ft.
	d. Second nodule seam	2 ft.
	e. Irregular bands of nodules sparsely distributed	variable.
	f. A soft bluish limestone	50 ft.
	g. A white limestone with chert nodules	100 feet.
	h. Fourth nodule seam.	3 to 4 ft.

The second seam is more regular in character, and extends uninterruptedly throughout all of the plateaux. In this respect it offers a marked contrast to seam one, which often thins out and disappears.

It consists of an aggregation of irregularly shaped nodules, intermixed with which are considerable quantities of the phosphatized remains of molluscs, corallines, echinoderms, crustaceans, sharks, whales etc. the whole being firmly bound together by an interstitial cement composed of foraminiferal and other calcareous matter similar to that of which the overlying beds are made up. It has an average thickness of two feet, and is very uniform in its general, physical, and chemical aspects.

The limestone matrix in which the nodules are embedded is of a very soft nature and readily disintegrates before the constant and insidious attacks of the Scirocco. The nodules contained in it, therefore, drop out in considerable quantities and falling to the bases of the escarpments they become incorporated with the soil of the fields, either by the transporting agency of rain or by the hoe of the husbandman.

The third seam is the poorest of the series. Its nodules are small, in size and few in number, and those that do occur are very irregularly distributed. Sometimes this seam consists of two or more thin layers of nodules none of which exceeds three inches in thickness. At Maddalena, near the northern extremity of the Great Fault, three of these small layers are distinctly shown, the upper of which disappears in an easterly direction beneath a talus of soil, but to the west it thins out and breaks off abruptly. It seems to be a purely local development, for it does not occur in any other part of the island.

Between these and the next, or lowest layer, is a bed of rock varying in thickness from 50 to 80 feet, underlying which is the fourth and most important seam of the series. The organic remains contained in it are more varied, and the nodules are larger, richer, and much more numerous. It averages $3\frac{1}{2}$ feet in thickness, and ranges from 3 feet to $4\frac{1}{2}$ feet.

The nodules are of a dark chocolate colour, and they generally present an exceedingly wrinkled and coriaceous appearance. Most of them contain

one or more fossil organisms around which the phosphate of lime seem to have segregated. The numerous sections that I have examined under the microscope (1) show the larger nodules to be almost entirely made up of the casts of *Globigerina* intermixed with a few other foraminifers.

The phosphatized remains of larger organisms are also extremely abundant. Casts and shells of molluscs, echinoderms, and corals; portions of the carapaces of turtles, the teeth and bones of teleostean fishes, of sharks, of whales and other mammals; and innumerable quantities of the casts of the pteropods, *hyalae*, and *vaginella* are a few of the many that enter in to the composition of this seam. The following calculation shows the amount of phosphate of lime that the organisms contained in this one bed would yield.

The bed is persistent throughout Malta and Gozo; for my purpose I propose to consider Malta only. Estimating the area of Malta at 95 square miles, and the average thickness of the seam as being 3 feet, we obtain as a result, 7,945,344,000 cubic feet of rock.

Supposing that not more than one thousandth part of this to be available for quarrying purposes, a very modest estimate indeed, we should obtain 7,945,344 cub. ft. which at 25 cub. ft. to the ton would represent 317,813 tons of a medium grade phosphate rock in the one seam only.

The origin of these nodules and the phosphatization of the limestone in which they are embedded afford us a problem for solution that is of great interest.

The occurrence in the phosphate beds and Globigerina Limestone of two groups of echinoderms, that varied widely in their distribution and characters when living, show that the Maltese area during the Miocene period was situated on the border-line which divided the Mediterranean into two parts, each of which differed from the other in its physical aspects and conditions.

The alternate elevations and depressions to which the Maltese area was then frequently subjected led to changes that caused the intermingling of the shallow-water fauna that had migrated

(1) I owe much to the courtesy of Dr. John Murray who kindly lent me the numerous sections of Malta rocks that he had had prepared.

from the western, with a deep-water fauna that had migrated from the eastern-basin (1).

Comparing these facts with those that the nodule seams themselves now supply us with, it seems reasonable to suppose, that each seam marks a period at which one of these physical changes in the sea bed took place, and which, by altering the conditions most favourable to the then existing marine flora and fauna, it caused all organic life then existing in the waters to die off suddenly and to leave their remains distributed in thick, regular layers over the sea bed.

It was from these remains that the phosphoric acid was derived, which now enters so largely into the composition of the rock.

The origin of the nodules themselves is more obscure. Alluding to this subject Dr. John Murray remarks that the nodules found in the Malta beds are precisely similar to the phosphatic nodules that were dredged from modern sea beds during the "Challenger" cruise, and he is of opinion, that both were formed *in situ* at the bottom of the sea.

The following table gives the result of the analyses of the Maltese nodules, made in 1890 and 1891 by Dr. John Murray and Prof. J. F. Blake respectively.

DR. MURRAY'S ANALYSIS.		PROF. BLAKE'S ANALYSIS.	
Sulphate of Lime Ca SO_4	2. 26	Sulphate of Lime	1. 97
Carbonate of Lime Ca CO_3	47. 14	Carbonate of Lime	51. 12
Phosphate of Lime $\text{Ca}_3 2 \text{PO}_4$	38. 34	Phosphate of Lime	31. 66
Alumina $\text{Al}_2 \text{O}_3$	5. 98	Alumina etc. (indeterm.)	10. 55
Oxide of Iron $\text{Fe}_2 \text{O}_3$	trace	Silica	3. 83
Residue	6. 08	Moisture	. 87
	99. 80		100. 00

In Prof. Blake's analysis the nodules and equal parts of the interstitial cement were taken, whereas Dr. Murray took the nodules only.

The following is the analysis of the interstitial cement.

Carbonate of Lime (Ca CO_3)	86. 69
Phosphate of Lime ($\text{Ca}_3 2 \text{PO}_4$)	1. 24
Sulphate of Lime (Ca SO_4)	0. 07
Alumina ($\text{Al}_2 \text{O}_3$)	1. 28
Insoluble in dilute H Cl.	9. 87
	99. 15

From these tables it will be seen that the amount of phosphoric acid contained in the matrix is so small, and the amount of calcium carbonate is so great, that were the matrix not separated from the nodules it would lower the market value of the product to such an extent as to render it worthless.

This separation may however be easily effected owing to the soft character of the limestone in which the nodules occur.

Several experiments have already been made on a small scale the *modus operandi* of which was as follows. Masses of the phosphate rock were broken up into small blocks averaging from 3 to 4 inches in diameter, after which they were transferred to a kiln for calcination. When ready, the material was subjected to a powerful stream of water and screened by which means the nodules were obtained free from the matrix, the former remaining in the sieve, and the latter passing though it as quick-lime. The nodules were then dried and crushed into a fine powder, which on analysis gave 41. 5 % of phosphate of lime, with no trace of iron, and but slight traces of alumina.

This shows the Malta rock to be but of a low or medium-grade, yet it is much richer than the Belgian phosphates that are now in the European market and that do not average more than 29 % of phosphate, with 63 % of lime. It is therefore hoped that some means may be devised whereby the Maltese phosphates may be put on the Italian market as there is at the present time a brisk demand in that country for low-grade rock.

(1) *The Maltese Fossil Echinoidea* by J. W. Gregory, F.G.S., Proc. Roy. Soc. No. 22. Vol. 36.

Changing Climate.

That Europe is passing through a cold period has been pointed out by M. Flammarion, the French astronomer. During the past six years the mean temperature of Paris has been about two degrees below the normal, and Great Britain, Belgium, Spain, Italy, Austria and Germany have also been growing cold. It is uncertain whether this is a local and temporary effect, or whether the globe is undergoing general refrigeration. The change seems to have been in progress in France for a long time, the growth of the vine having been forced far southward since the thirteenth century; and a similar cooling has been observed as far away as Rio Janeiro, where the annual temperature has been going down for some years. In Denmark, Norway, Sweden and Russia, on the other hand, the last four years have been slightly warmer than the average.

The Hope of France.

French science has to deal with a peculiar problem, how to prevent the depopulation of the country, which is now going on so rapidly that the deaths exceed the births by nearly 40,000 in a single year. Increasing the birth-rate having proven impracticable, the present hope is to diminish the death-rate. At a recent meeting of the new Society for the Protection of Children, Dr. Rochard referred to the fact that only eight years ago he was laughed at for predicting that the population would become stationery before the end of the century, and stated that 250,000 infants die yearly, of whom at least 100,000 could be saved by intelligent care. Stringent laws have been already passed to aid in preventing this great waste of life. It is now illegal for any person to give children under one year of age any solid food except on medical advice, and nurses are forbidden to use nursing bottles having rubber tubes. Efforts are being made also to induce Parisian mothers to nurse their own infants.

Prehistoric Man in Italy.

In an interesting monograph by Sig. A. De Blasio entitled "*L'uomo preistorico in Italia considerato principalmente dal punto della visita craniologica 1891*", some valuable information is afforded us regarding the mode of life, habits, and occupations of the peoples of prehistoric Italy.

Special mention is made of the characteristics of the various prehistoric human skulls that have been exhumed in various parts of the peninsula, but without referring to any of the side issues bearing on its paleontological aspects.

The author considers the prehistoric era of Italy under the well known divisions of the Stone age, and the Bronze age.

The Stone age he again subdivides into the orcheleotic epoch and the neolithic epoch and he then proceeds to consider in detail the various skulls, five in number, that have up to the present time been assigned to this period. The five specimens to which allusion is made are as follows of each of which the author gives a brief but succinct description.

1. The cranium of Olmo illustrated by Cocchi 1862.
 2. The cranium found in the travertine of Orvieto, and now in the possession of the Marquis Gualterio.
 3. The cranium found among the sands that underlie the travertine near the island of Liri and which was described and figured by Nicollucci 1871.
 4. The two skulls found at Arpino near Capistina and described by the Author 1890-1891.
 5. The skull found at Mezzana which was described by Vogt and figured by Sastaldi 1866.
- The last of these is barchicefal, but the others with the exception of that of Orviet are dilococefal. The specimen from Orviet is too fragmentary to admit of a specific determination, therefore its assignment to either of these epochs would be doubtful.

In fact none of the skulls with the exception of those from Arpino are entire, and the absence of the facial bones will not therefore allow of its being determined as being ortogenated or progrenated.

The men to whom they formerly belonged were evidently carnivorous. They fed on fish, fruit, and flesh, the products of the chase, but though they clad themselves in hides they had no notions of the manufacture of earthenware.

The skulls assigned to the neolithic age are far more numerous. Several specimens were found in a cavern at Arene Candide near Finalmarina in Liguria (Issel), in the cavern of Matta near Savona (Deo Gratias), in the caves of Calvanissetta (Minà Palumbo e Fiorino), in the caves of Monte Tignoso (Gastaldi, Cocchi, Zampa, Strozi), in the caves of Vecchiano in Pisano (D'Achiardo) at St. Ilario d'Enza (Chierici) and at Cantalupo near Tivoli (Ponzi e Rossi). Most of the skulls were dolicocephals and brachicefals, and in comparison with the archeolitic they are more developed and present typical modifications that seem to indicate that they belonged to a new race that immigrated into Europe.

These neolithic men worked instruments of stone, lived in edifices erected in the open, built fences for protection and by insensible degrees merged their customs into those of the people who seem to have been constantly migrating into the peninsula at the commencement of the bronze age.

To the bronze epoch belong the notes that have been described by various authors as well as the rock tombs, the megalithic ruins, the cromlechs or circles of stone and the nuraghi. The Author gives a short description of each of these and then proceeds to give details of the skulls that have been found in Italy and assigned to the bronze age.

Of these two were found in the Tower of Mainà (Nicolucci); three were found in a grave in the island of Elba (Foresi), and one at Valcuvia (Maggio). These specimens are of various forms, the last being mesaticephal, but in all of them a much greater development is noticeable in their cranial capacity when compared with those belonging to the other epochs.

The iron age the author considers as belonging to the historical period and he does not therefore mention it. In conclusion he points out the gradual typical and intellectual development that these evidences prove prehistoric man in Italy to have undergone. The type which diverges in the

greatest degree from that of modern man in Italy is that which has been found in the later deposits of the Quarternay epoch and this continued to our own times.

In the neolithic epoch the geographical distribution of race, was similar to that which now exists that is:—

Barchicefals in Southern Italy.

Dolicocephals in lower Italy,
and Mixed in Elba, Umbria and central Italy.

The Fathomed Depths of Ocean.

It was held by Maury, once the supreme authority upon oceanography, that the ocean might be as much as eight or nine miles deep, but recent investigations show that the mean depth of all the seas cannot be more than 2,500 fathoms. The deepest soundings yet taken are 4,655 fathoms off the northeast coast of Japan, one of 4,575 fathoms south of the Ladrões, and a third of 4,561 fathoms north of Porto Rico, far from St. Thomas. The greatest depth found in the North Atlantic is 4,561 fathoms, and none as great has been met with in the South Atlantic. No part of the Mediterranean is known to be more than 2,150 fathoms deep, and the maximum depth determined in the Indian Ocean is 3,199 fathoms. The polar basin seems to grow shallow toward the North Pole, until at a point within four miles of the most northern ever reached, Capt. Markham found bottom at 72 fathoms.

The Relationship of the Structure of Rocks to the conditions of their Formation.

BY H. J. JOHNSTON LAVIS, M.D.

Intrusion of Igneous Matter into Porous Aquiferous Strata.—The same results as in the last case may be looked for, but we shall see that superposed upon them there is another series of far greater importance. Let us suppose the fissure formed, injected, and that a salband has solidified. The water in the immediate neighbourhood will tend to increase in temperature until it arrives at the same degree as that of the lava, since in most cases the enormous superincumbent pressure will

have proportionally raised the boiling point. Then again, as the water exists bound up, as it were, within the pores of some permeable rock, little convection circulation is permitted, at the same time that expansion to the gaseous condition furthermore is resisted. This shell of superheated water is only separated from the igneous magma by the salband, which according to varying circumstances may differ very much in thickness, and so will act as a more or less imperfect porous septum between the igneous matter and superheated water. Although probably not possessing exactly the same physical characters as the porous septum in dialysis, nevertheless it no doubt would permit diffusion to go on between the two fluids which it separates, or even the porous rocks themselves may play that part. Besides, we have another striking resemblance to the process of dialysis, for the igneous magma is in a vitreous state, which we may take as the representative of the colloids, (1) whilst the superheated water in all probability may still be regarded as a crystalloid. In consequence of this we should look for endosmosis as the principal function, although the metamorphism of surrounding rocks, which in the case of the existence of salbands is comparatively slight, would indicate some amount of exosmosis. In the case of the blind fissure being converted into a channel through which the igneous magma circulates, then no doubt the salband would, in most cases, be refused or carried away by other means, and the permeable rocks would then play the part of the septum. In fact, even in a blank fissure we can comprehend that no salband may exist.

The rapidity of this endosmosis of water, and its diffusion through, or solution in, the colloidal-like magma, will obviously depend upon a variety of circumstances, such, for instance, as the composition of the magma, the form of fissure, and therefore amount of surface exposed, pressure, &c. This we see portrayed in the illustrations we chose; for if carbonic anhydride is in contact with the calm surface of water, solution takes place very slowly. A knowledge of this fact is practically made use of in the seltzer-water machine, in which a number of lashers revolve with great rapidity in

a chamber filled with water and the carbonic anhydride, so that a very large surface of each is brought into contact by the churning motion, and consequently solution takes place with very great rapidity.

But to return to the main question, this absorption of water will go on at the expense of heat to the igneous magma, which, however, will only lose so much as will raise the amount of water absorbed to its own temperature. This loss will not, of course, be very great, since there is no conversion of a liquid into a gas. Nevertheless this loss of heat, combined with that due to the conduction away by the surrounding rocks, may be so great that the igneous magma may reach its point of solidification, and further action will be prevented by the fissure being now filled by a cooled rock mass.

On the other hand, should such not have taken place, as the amount of water absorbed increases, the tension of the fluid mass will proportionally do so also. There will arrive a time when the tension of the fluid mass will exceed the resistance of the surrounding rocks, or the superincumbent pressure, which will result in the rending asunder of them and the extension of the fissure. Such extension may be sufficient to make it reach the surface forming the site of a volcano, or as it extends and gives place for expansion the tension may proportionally so decrease until the balance is restored before the surface is reached. The extension of such a fissure will rather tend towards the surface, as least resistance would be encountered in that direction. We may thus have a dyke, a laccolite or a volcanic neck. Contact metamorphism is very little in the first more in the second and well marked in the third if the volcano produced has been permanent so that the neck becomes a feeder canal.

Such an extension of a fissure will give rise to two or more very distinct series of vibrations: first, we shall have slow ones extending over a considerable length of time, due to the gradually increasing compression around the expansible matter which, if apparent at the surface, would assume the characters rather of tilt than that of an earthquake. Local elevation of a small area such as occurred at the Starza of Pozzuoli, pending some years before the outburst and for-

(1) *At any rate as far as the silica, and probably the alumina and iron oxides, are concerned.*

mation of Mount Nuovo, or the same thing at Torre del Greco in the Vesuvian eruption of 1861. The actual rending and enlargement of the fissure will give rise to a series of vibrations of small amplitude, such as are first registered in an earthquake (1). These will be immediately followed by the sudden arrest of expanding matter coming in contact with the walls of the fissure, which space it injects immediately. The effect is well imitated by allowing steam to escape from a boiler under high pressure, and suddenly closing the opening. Other examples are the sudden injection by water of a blind and collapsed hose, or the rapid closing of a tap from which was flowing a stream of water under pressure, conducted through a pipe of some length. This impact of the fluid matter against the solid fissure walls is followed by a series of diminishing oscillations or throbs. This group of disturbances no doubt constitute the more powerful or destructive portion of the earthquake, and the character of these vibrations, which we should deduce on the above theoretical grounds, completely coincide with earthquake registration.

The extension of the fissure may have been sufficient to allow of the formation of steam, which may collect together throughout the pasty mass as bubbles; and, should solidification soon follow, the resulting dyke-metal would present a vesicular or amygdaloidal structure. On the other hand, the expansion may only have taken place to such a point, that no conversion of liquid into gas has taken place, and as a result we should look for, in case of solidification, a dyke presenting no signs of vesicularity. The finding of a dyke-metal, in which no vesicularity is manifest, is no proof that at some time it may not have had such; for, were cooling not to follow soon on vesicularization, the renewed gradually increasing pressure would again compel the steam to redissolve in the magma. These facts probably account for the rarity of a vesicular state of granite, though even this is sometimes known to occur as in the island of Mull, and that of the plateau of the *Palais du Roi*, Lozère, described by Lecoq (1).

Under the two former circumstances we should expect the first to end in solidification more often than the second; for, by the conversion of the

dissolved water into steam, a very much larger amount of heat would be used up, proportionally of course to the amount of conversion that took place.

By the progressive extension of the fissure a larger area of igneous rock surface will be exposed to the conditions which have been described, so that the tendency will be towards the more rapid absorption of water, and consequent crisis between tension and resistance. Besides, from the larger amount of expansive matter capable of acting, the effects will be more violent each consecutive time.

The facts are borne out in such examples as Jorullo and Monte Nuovo, and are now probably in progress under Casamicciola, in the island of Ischia. In such examples we find, that for a long period earthquakes occur at distant intervals, but that these have a gradual tendency to follow each other progressively more often, and often increasing in destructiveness at one spot, although the area affected may proportionally become more concentrated. At last the frequency may become so great that the intervals are almost imperceptible until the fissure reaches the surface, and the igneous matter finds a vent for its expansion.

(to be continued)

The Great African Cataract.

A late visitor to the great Victoria Falls of the upper Zambesi River, which were first described by Livingstone, states that their grandeur is unseen and for that reason it is impossible to compare them with Niagara. The immense river, about a mile wide at this place, suddenly contracts and disappears, apparently into the bowels of the earth, falling from a height estimated at about 400 feet into a gorge narrowing to about 500 feet. A column of spray rises at least 300 feet above the level of the river, and may be seen seven miles away, while the roar can be heard for many miles. But in no place can the bottom of the gorge be seen, and in only one place was it possible to survey as much as 600 feet in width of the falls at one time.

(1) J. A. Ewing, *Earthquake Measurement*, Mem. Sci. Depart. Univ. Tokio, No. 9, p. 54, & following.

(1) *Les époques géologiques de l'Auvergne*, I., page 465.

The Tunny Fishery in Sicily & Sardinia.

"Neptunia" contains a well written article with the above title by G. Hütterott of which the following is a brief abstract.

The tunny fishery in Italy during the last four years has yielded on an average 2,000,000 francs a year. Forty-two tunny stations have been at work with the following results.

hundredweight, represents a value of 1,440,000 francs without reckoning the value of the fish oil extracted from the bones, or of the manure into which the bones are afterwards made. The two stations, that belong to the Marchese di Genova were bought with the islands of Favignana, Formica, and Marittima many years ago by Comm. Florio for the sum of $3\frac{1}{2}$ million francs the two tunny stations being estimated at 1,400,000 francs.

	1889	1888	1887
13 off the coast of Tireno	150,000 francs	120,000 francs	175,000 francs
1 " " " " Mar Jonio	20,000 "	37,000 "	35,000 "
22 " " " " Sicily	1,120,000 "	775,000 "	1,080,000 "
6 " " " " Sardinia	710,000 "	1,268,000 "	1,268,000 "

No tunny fishery is carried on off the Italian coast in the Adriatic. The most important is the Sardinian fishery, especially that of the island of Piana, of Porto Scuso, of Porto Paglia, of Flumentorcio, of Cala Vinagra near Cagliari and of the salt works near Maddalena; after which comes the Sicilian, of which the fisheries conducted at Favignana and Formica near Trapani, of Scopello, Solanto and St. Elia near Palermo, of Milazzo and Oliveri near Messina, of Marzaneni and of Cape Passero near Catania are the principal.

These stations, some of which date back to very ancient times, give an average of more than 1000 hundredweight of fish each, while many of them greatly exceed that number, producing oftentimes several thousands of hundredweights. At the two tunny stations of Favignana and of Formica near Trapani in Sicily, the latter of which is of but minor importance, are taken during a season consisting of a month or five weeks, an average of 6000 fish of an average weight of 180 kilos each; and a few years ago as many as 17,000 were captured during one season at these two stations.

Reckoning the average weight of a fish as being 180 kilos, then 15,000 fish would weigh 27,000 hundredweight, and calculating their value at the low rate of 30 francs a hundredweight we obtain the sum of 810,000 francs.

From these two tunny stations there has been brought during one season to Genoa—the principal tunny market in Italy—12,000 hundredweights of tunny preserved in oil, which at 120 francs a

Florio introduced many important changes, from which he now realizes handsome profits. There are several other examples, equally striking, where the introduction of improved apparatus and methods has met with equal success and large sums of money are being made.

All of the tunny fisheries commence operations when the fish are migrating, excepting the stations at the east of Sicily where operations are also continued during the months of July and August when the fish all returning. The latter time is not so productive as is the former.

Since 1878 the Italian fishermen, especially those of Genoa, have gone annually to the coasts of Spain and Portugal to fish for tunny.

The fish is afterwards preserved in oil at establishments near Cadice in Spain, and at Villareale in Portugal which have been built by and are directed by Genoese merchants, after which the fish so preserved is shipped to Genoa.

The fish taken off the Spanish and Portuguese coast are not of so fine a quality as are those that are fished from Sicilian and Sardinian waters, a fact that is evidently due to the *penchant* that the larger fish have for deep waters, while the smaller ones keep near the shore.

The average weight of a fish taken off the Spanish coast is but 120 chilograms, while the Sardinian fish average 150 chilograms each, and the fish from Sicily 180 chilograms.

The author then proceeds to give some interesting details regarding the market prices of the

fresh and the preserved fish, and he points out the principal causes of price fluctuations.

The average price at which the fresh fish sell is 35 francs per hundredweight on the beach; but when preserved in oil and packed in barrels it fetches 130 francs per hundredweight at the fishing stations. In the season these prices rise, and the fish often sell in Genoa at 200 francs per cwt. In Sardinia the fishing season usually begins on the first of May, and lasts till the end of June; but in Sicily it does not commence till the 20th of May and terminates about the 10th of July.

A tunny fishery equipment consisting of nets and boats costs from thirty thousand to sixty thousand francs, but many of the stations with stores and apparatus represent a value of several hundreds of thousands of francs.

The work of watching for the fish is very exciting. After the nets are laid the fishermen station themselves, and wait the arrival of the shoals. When the sea is smooth the approach of the fish is heralded by a movement of the surface waters, but when this is not possible, a number of wires with small weights attached are cast into the sea and are held at one extremity by the men.

The passage of the fish is then known by the grazing of their bodies against the wires. As soon as the shoal is well within the area of operation, the nets are closed, and the fish are kept confined until the time comes for hauling in.

Occasionally great damage and loss is caused by the imprisonment, with the shoal, of a dolphin or shark. The former is especially dreaded owing to its activity, for it seldom fails in breaking its way through the nets, and with it, often goes the greater portion of the imprisoned tunny.

To guard against such a *contretemps*, additional nets are always kept in readiness, to prevent the escape of the fish, and to enable the fishermen to effect the necessary repairs in the broken nets. The paper concludes with detailed descriptions of the various methods adopted for preserving the fish, and for extracting the oil contained in them.

The Vine Disease in Sicily.

Valletta, 20th June 1892.

To the
Editor of the "Mediterranean Naturalist"

Dear Sir,

At this time when the "Peronospora" is committing such ravages on the West Coast of Sicily, it may be useful to read the following brief description of this scourge as well as to study the remedy prescribed, in the event of this disease paying a visit to our Islands where there are already considerable vineyards making good progress. You may consider it worth while giving it to the readers of your valuable journal.

HENRY TWELVES.

The "Peronospora" is, so to speak, a mouldiness or fungus which is developed on the green parts of the vine.

It is chiefly to be found on the leaves and the budding bunches of grapes near maturity.

The Peronospora is detected on the leaf by white spots on the underside, which afterwards become reddish brown.

Not wishing to depend entirely upon the symptoms presented to the view in this disease, one can have recourse to the smell, rubbing a diseased leaf between the fingers. If it emits a smell like that of a rotten fish, it is beyond all doubt that the vine is attacked with Peronospora.

This fungus disorganises the plant and causes the leaves to fall, dried and rotten. It is propagated by means of microscopical spores or germs which are of two species, the summer and the winter ones. The summer spores develop with extraordinary rapidity and in enormous quantities. They live but a few hours or at the most a few days, whilst the winter spores retain their germinating faculties for several months, resisting the action of cold and damp, even when the leaf which houses them in rotten.

The great damage done the vines by the Peronospora is well known.

The Spring infection causes more damage than the others, because it attacks the new leaves and fresh bunches; and the Autumn one is also disastrous, as, by causing the leaves to fall, it prevents the proper ripening of the grapes.

Besides the destruction of leaves, bunches and shoots, the effects of the *Peronospora* are also to be felt in the produce, for the infected fruit communicates to the wine a disagreeable bitter taste, and the wines produced from the grapes of diseased vines are of very inferior quality. The discovery of the only remedy for effectually combating the *Peronospora* is due to Chanel. This remedy is the sulphate of copper.

It may be applied either as a liquid or in powder. The most efficacious powder is that composed of sulphur and sulphate of copper in the proportion or from 3 to 5 per cent, and should be applied when the leaves are still wet with the dew.

The best liquid remedy is, the simple solution of sulphate of copper in water in the proportion of from 2 to 3 per mille.

NOTES AND NEWS.

VESUVIUS ACTIVE:—Vesuvius is again active, and considerable masses of lava have been flowing into the Atrio di Cavallo ravine during the last month.

SUNFLOWER OIL:—The cultivation of the sunflower has become an important industry in Southern Russia, where it is grown chiefly for the tasteless oil yielded by its seeds. This oil is taking the place of olive oils for domestic purposes in that region. The pressed seeds and the boiled leaves are utilized as food for cattle, while the stalks make good fuel. Like the eucalyptus, the sunflower dries the soil, and operates against malarial germs.

OUR GLOBE:—According to Dr. John Murray the ratio of dry land to water on this globe of ours is as 1 is to 2½ nearly that is the area of the dry land is 55,000,000 square miles, while the area of the oceans is 137,200,000 sq. miles.

He estimates the mean height of the land above the sea to be 2,250 feet, and the mean depth of the ocean to be 12,480 feet.

TO OUR SUBSCRIBERS:—With number 13 Volume II commenced. We desire to call our readers' attention to the notice having reference to subscriptions on the first page of the present number.

A REMARKABLE CUSTOM:—A singular custom, mentioned by Dr. A. H. Post as having originated in India, is a symbolical marriage with plants, trees, animals or inanimate objects. It is believed to avert the evil consequences liable to follow a violation of traditional ideas. In some regions, for instance, a girl must not marry before her elder sisters, but in southern India the difficulty is overcome by having the elder sister marry the branch of a tree.

FLORA OF THE MEDITERRANEAN:—The shores of the Mediterranean, the "Mare Internum of the ancients, and" Mare Nostrum of Pomponius Mela, include about three million square miles of the richest country on the face of the globe. In the eastern part the flora and fauna do not essentially differ from those of Italy; in the west they resemble those of Spain. One of the noblest of the Atlantic conifers (the *Abies pinsapo*) is found also in the Iberian peninsula, and nowhere else in the world, and the valuable alfa grass or esparto (*Stipa tenacissima*), from which a great part of our paper is now made forms one of the principal articles of export from Spain, Portugal, Morocco, Algeria, Tunisia, and Tripoli. On both sides of the sea the former plant is found on the highest and most inaccessible mountains, amongst snows which last during the greater part of the year, and the latter from the sea level to an altitude of 5,000 feet, but in places where the heat and drought would kill any other

plant, and in undulating land where water cannot lodge.

PREHISTORIC MAN:—A few months ago some fossil remains were discovered in a tertiary formation at Archese in Italy, which on being examined were said to be portions of a human skeleton. Considerable excitement prevailed in scientific circles, owing to the undoubted origin and the great antiquity of the formation out of which the remains were taken. The bones have since been forwarded to Prof. Capellini, the learned Bologna paleontologist for examination. He pronounces them to be the bones of a creature allied to the dolphins, similar remains of which have also been found in the rocks around Bologna.

ANTS AND AGRICULTURE:—What the earthworm does for the alluvial tracts around the Nile, the ant performs for the soil in Mashonaland. Referring to this subject, in his account of his travels in Southern Africa with the Hon. Cecil Rhodes Mr. De Waal thus describes the value of the work of the ant in the rural economy of the districts through which he passed. Wherever an ant-hill is found in the veldt, there is also luxuriant verdure, and in Mashonaland the ant-hills can be literally counted by the million.

The whole of the soil is, as it were, turned over and thrown up to the surface by these little toilers, who in Africa perform the function which Darwin tells us is performed by the earthworms in other countries.

Wherever you have an anthill, you have fertile soil and sweet grass. It grows so luxuriantly that it is a common saying that you can pasture an ox on an ant-hill.

Mr. T. D. Russel of 78 Newgate St. London, has favoured us with a set of catalogues of naturalists requisites.

PROPOSED MEDITERRANEAN SURVEY:—The numerous accidents that have happened of late to ships both of the Royal Navy and of the Merchant service by running on unknown rocks and shoals in the

Mediterranean render it desirable that a more complete survey of that sea should be undertaken. In reply to a question on the subject in the House of Lords, Lord Elphinstone stated that many parts of the Mediterranean have never been surveyed on account of the difficulty experienced in obtaining the consent of the respective governments. A more complete survey is, however, about to be made of the Greek Archipelago.

MONKEY LANGUAGE:—Of the many remarkable uses to which the phonograph has been put none, perhaps, bids fair to be attended with more interesting results than that which has for its object the investigation of the various sounds made by animals when communicating with one another.

Writing on this subject a correspondent to the Spectator says. "Some attention has been aroused by the recent attempt to reproduce monkey-talk by means of the phonograph. It is perhaps not generally known that in a little book, published nearly a hundred years ago, at the sign (strangely enough) of the Tour de Babel, on the Quai Voltaire, Paris, a French writer made an endeavour to reduce the chatter of the tiny marmoset to articulate translatable language. The whistle, or *ouistiti*, from which this little creature has its French name, he describes truly as a long, sharp, piercing sound, repeated two or three times, signifying the want of something or some one. I would add to this, that it is evidently the call used by one to the other. A very young one that I had always cried 'Ouistititi, ouistitititi,' to the older one for help, if it thought itself in danger. 'Ghrii,' a long-drawn high tone, he translates into 'come.' All those that I have possessed have thus called me to come to them. 'Guenakiki,' expresses, he says, terrible fear; 'Trouakki,' violent, despairing grief; 'Trouagno,' intense pain, 'save me.' One that had broken its leg thus warned me of it. 'Krrreoeoeo,' often repeated, means very happy indeed; 'Keh,' a little better; 'Korrie,' annoyed, disturbed; 'Oocoo,' deep terror; 'Anic,' feebly and melo-

diously uttered, means help! protect! 'Quih,' 'I want something very much,' 'Quouéé,' despair of escaping some danger,—this sound I have often heard all my marmosets make at the sight of anything strange to them, or which reminded them of some known danger." —

THE MOSQUITO:—In tropical climes one of the worst pests that man and beast alike have to content with is the blood-sucking mosquito. Familiar, however, as its victims are with its insidious and persistent methods of attack, and the peculiar intensity of the pain that its sting gives rise to, few have any idea of the complicated apparatus with which this "mite of creation" works its mischief.

Discovery tell us that the beak of the mosquito is simply a tool box, wherein the mosquito keeps six miniature surgical instruments in perfect working order. Two of these instruments are exact counterparts of the surgeon's lance, one is a spear with a double-barbed head, the fourth is a needle of exquisite fineness, a saw and a pump going to make up the complement. The spear is the largest of the six tools, and is used for making the initial puncture; next the lances or knives are brought into play to cause the blood to flow more freely. In case this last operation fails of having the desired effect, the saw and the needle are carefully and feelingly inserted in a lateral direction in the victim's flesh. The pump, the most delicate of all six of the instruments is used in transferring the blood to the insect's "stomach."

A HINT:—*Apropos* of our too lively winged friends, one of the best means of ridding a room of their presence is the following. Heat a piece of camphor in a tin can over the flame of a lamp, in such a manner as not to allow the camphor to ignite. Allow the fumes to fill the infested room. It will be rapidly cleared, and no further attempts to enter will be made by the pests for several hours after the operation.

The *Peronospora* has appeared among the vines in several localities in Malta.

FLORA OF ELBA:—Dr. P. Bolzon has contributed to the last number of "Rivista Italiana di Scienze Naturali" an interesting article on the Elban flora. Of the sixty-eight species that are peculiar to the archipelago twenty only are found in Elba, among which are *hychnis laeta*, and *convulvulus siculus*.

DR. JOHN MURRAY IN AMERICA:—Dr. John Murray, the eminent "Challenger" naturalist whose visit to these islands will be still fresh in the memory of our readers, is at present in the United States. He recently delivered a series of lectures on the "Challenger" results to the scientific bodies of Boston.

HABITS OF HERMIT CRABS:—A correspondent to the *Field* gives us an interesting account of the habits of the hermit crabs of Northern Madagascar.

Among the many species that inhabit the shore, the most common was a light grey variety which lived for the most part in the branches of the trees and bushes. They preyed upon the frigate birds (*Tachypetes aquila*) and gannets (*Sula*) which nested in there in hundreds. The writer saw them in the act of devouring the bodies of the birds.

VINE DISEASE IN SICILY AND GREECE:—The vineyards of western Sicily, and of Pyrgos and the neighbouring districts in Greece are being invaded by the *Peronospora* a fungoid growth which attacks the vines and causes the leaves and fruit to wither and rot away. The Minister of Agriculture for Italy has caused immediate steps to be taken to prevent the spread of the disease to the other districts in Sicily.

In Greece the infection has made rapid progress, and great distress is anticipated among the vine growers.

The Greek government has sent the professor of Botany to the infected districts: little hopes, however, are entertained of his being able to do anything to save this year's currant crops.





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The Mediterranean Naturalist.

A Monthly Journal of Natural Science. Subscription 5/- per annum.

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NOTICES.

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Subscriptions are now due.

Special Notice to Readers.

Subscribers are requested to note that Volume II, commences with the present number.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

Eruption of Etna.

July 1892.

On the 8th of July last at about 10. 30 p.m. the first manifestations of violent activity in the central crater of Etna that have been felt since 1886 were made apparent by the emission of a dense volume of steam and of fine dust, and a few hours afterwards low rumblings within the mountain accompanied by several slight shocks of earthquake apprised the Catanese of an approaching eruption. About 1. 20. p. m., activity in the crater increased, and a constant shower of fine sand, cinders, and bombs was ejected until 2. 33 a.m., when a strong earthquake having an undulatory movement from north to south was felt, after which all action in the main vent subsided.

About mid-day, volumes of steam and smoke were seen to issue from the south-western slopes of the mountain between Mount Foggi and Mount Nero, in close proximity to the locality in which the eruption of 1886 had its origin, and shortly afterwards a stream of lava slowly made its way round the foot of Monte Albano in the direction of Nicolosi, enveloping *en route* considerable portions of the lava of 1886.

During the five following days several fresh vents were formed, from each of which a lava stream burst forth, and by the 16th inst the cones of Monte Grosse, Monte Albano, Monte Gemellaro, and Monte Montanaro were completely surrounded by a molten sheet. On the 15th inst the main crater ceased its action altogether, but numerous others were formed, making a total of thirteen in all, five of which were of considerable magnitude.

The lava streams that issued from these, coalesced on the 16th and formed one great mass which up to the 20th inst continued steadily advancing in the direction of the towns of Nicolosi and Belpasso, both of which were at one time in imminent danger of being overwhelmed. The rate of the descent of the lava varied from 50 to 80

metres per hour, but its average rate was 64 metres per hour.

A considerable amount of damage has been wrought in and around the seat of the outbreak. Farms, vineyards, olive groves, and chestnut plantations have been entirely overwhelmed either with lava or cinders, while many others that have escaped this fate, have been completely ruined by the scorching blasts that have swept across them during the last three weeks. To alleviate the distress of the "contadini" the Minister of the Interior has caused several sums of money to be forwarded to the district committees at Catania and Messina for the purpose of providing food and shelter for the unfortunate inhabitants of Nicolosi and the neighbouring villages.

Though the eruption is now abating, it is not expected that the mountain will be quiescent for some time to come.

It was on the 16th and 17th ultimo that the outbreak was at its height, and its appearance was then most impressive.

From Catania but little of the mountain, or of the seat of the eruption could be observed owing to the clouds of steam and smoke in which the Catanese slopes were enveloped by the north-westerly winds. But from Lentini or Augusta, towns that are situated about 15 to 20 miles farther south, the scene was sublime.

From Lentini especially, the whole environment was exceedingly rich and picturesque. The forty miles that intervened were abolished by distance, and the mountain appeared as though it arose directly from the purple waters of the surrounding Mediterranean. The sombre slopes in the immediate foreground stood forth in bold prominence, but as they receded upwards the opalescent clouds of steam in which they were swathed, and which rose in dense masses from the body of the mountain, seemed to soften the harshness of their more rugged features, and to shade them off by almost imperceptible gradations until the summits of Monte Rossi, Monte Albano, and the cones around them appeared almost to melt away in the intense, gentian blue of the Mediterranean sky. So numerous are the cones that take their origin in the venerable old mountain and that soar skyward that Etna may with Cybele boast its progeny as:—

"Omnes ceticolas omnes supera alta tenentes"

All of them have been formed by eruptions, and all of them have craters.

From Monte Capriola, M. Gemmelaro, M. Montanaro, M. Albano and nine other of lesser importance, rolled a long, revolving column of smoke, extending as far as the eye could reach, and exhibiting in the brilliant glare of the semitropical sun an almost endless variety of form and shade, the effect of which was still further heightened by the wraiths of silvery steam, the shimmering reflection from which imparted to the whole an exquisite charm of appearance.

And when, later in the day, the rays of the sun fell aslant the purple slopes and snow capped summits of the cones, and across the silvery gray sands which surrounded the base of the mountain and which formed a broad belt between it and the glorious plain of blue waters that spread around, the impressions that were then created were such as the spectator is never likely to forget. And as evening advanced the everchanging effects under the influence of the waning light were, if possible, even more charming. The rich colourings of the verdured districts between Catania and Nicolosi, and the russet brown of the cones and lava streams then softened in the misty distance, and the sheen of the sand-belt departed; and as the sun slowly disappeared behind the distant summit the snows shone golden, until on the horizon the farthest crests, and the gauze like streaks of steam and cloud took a rich amber tint, shading off into a pink flush which suffused sea and sky alike and formed the closing chord to a colour symphony of the most exquisite harmony.

But it was when night closed in that the nature and extent of the outbreak was seen to the best advantage. The burning craters and the seething lava streams, then made their presence known by the lurid reflections which they cast against the night sky, and against the steam clouds in which they were enveloped. The various recrudescences in the immediate vicinity of the main vents then appeared as so many black, fantastically shaped monsters standing invulnerable amid the hissing, seething masses of flames, while the courses of the lava streams themselves could be traced by the sinuous lines of living fire that radiated in all directions from the seat

of the eruption. The sight presented by these moving rivers of molten rock was most fantastic. Onward they moved down the mountain sides with irresistible force, now meandering through small valleys, and now precipitating themselves as cataracts of fire into lofty and precipitous gorges.

Oftentimes they met with impediments which arrested their progress: but it was not for long. Onward poured the molten rock and slowly the stream built itself up into a towering mound until sufficient had been accumulated to overcome the obstruction, when onward it went again with redoubled violence and rapidity.

In the meantime the craters continued to belch forth long tongues of flame into the blackness of night, and to eject showers of white hot scoriæ and bombs, the heat, glare, and noise of explosion of which, seemed to represent the very embodiment of what one's idea of a colossal pandemonium would be.

In the vicinity of Crifeo the effect of these repeated explosions was terrific. At very shock the earth trembled like an aspen and the deafening rumbling sounds with which each throb was accompanied afforded undeniable evidence of the awful extent of the fiery, unfathomable abyss that lay within the mountain.

From the doomed towns of Belpasso and Nicolosi the scene was the most awful and weird in the extreme, and darkness so far from taking from, really added a new effect and sublimity to it.

J. H. COOKE.

The Sponges of Tripoli.

The last report of the British Consul-General at Tripoli contains many interesting details bearing on the Sponge industry of this state. The sponge-fisheries are in the hands of Greeks and are carried on by means of numerous small craft, employing about 700 men amongst them. The fishing takes place in the summer months only, and by four different methods—viz., machine boats or those which are provided with diving apparatus, Kangara boats or trawlers, harpoon boats, and divers' boats. Last summer there were 21 diving machines in use, which naturally secure the best sponges, as the divers have time to select and cut

the sponges, whereas the trawl nets and ordinary divers tear them away from the bottom without examining them, and the harpoon boats can only fish in comparatively shallow water. These sponges, after being dried, are sent mostly to Greece, but there are a few buyers on the spot who send some to the London and Paris markets. The best sponges are found in the west of Tripoli, the quality becoming inferior towards the east. The diving is dangerous owing to the presence of sharks and to accidents such as remaining under water too long, or diving beyond the proper limits, which often exhausts the divers and proves fatal to them. The cost of licenses for fishing varies from £T3 to £T32, according to the mode by which it is carried on.

On the Meadow of Nysa in Asia Minor.

BY

CAPT. R. MOORE, R.N.

II.

A Zeybec in full costume is a most picturesque subject for the sketchbook. He appears to be composed, or built up, of six equal or nearly equal parts. The basement of the structure is his leggings of dark blue cloth, braided with black, and fastened below the knee with a red tasselled cord. Above this is a long stretch of bare, bronzed, and brawny thigh, indicative of the great muscular power and agility of these Turkish Highlanders, and extending upwards till it meets his short loose breeches of blue cloth, bound round his waist a cord, reaching the least possible distance downwards, puckered up on the thighs like bags, and projecting in the rear with a strange fulness, suggestive of the presence of the caudal appendage which is supposed to have adorned man before, in the process of evolution, he had entirely emerged from the pithecos state. His breeches are decidedly the shallowest of all the layers of which the Zeybec costume is composed. The fourth storey is a deep stratum of checked or variegated silk, covering a broad leathern belt which serves him for pocket and armoury. In it he stores his ponderous pistols inlaid with silver, his ramrod also, unless he is fortunate enough to possess a revolver, his writing-case, his cartouche-belt, heavy with

bullets for his Peabody breech-loader, and a formidable yataghan—all which articles thrust into his belt cause his figure to protrude in front fully as much as it does behind in the storey below. The fifth stratum is composed of a dark blue jacket and waistcoat, profusely braided, and so shallow on the back as scarcely to cover his shoulders, leaving a broad strip of shirt visible between waistcoat and belt. His long jacket sleeves hang loosely from his shoulders in collegiate fashion. His bushy head is crowned with a crimson fez; not the skull-cap worn alike by Turks and Greeks in the East, but tall and square-topped like a chimney pot, bound with a silk rag instead of a turban, and decorated with a bunch of flowers, strangely incongruous with the wild and often savage expression of his swarthy countenance. The better class of Zeybec wears round his neck, suspended by a silver chain, a small square case of the same metal, containing his papers, and another of triangular form holding some text from the Koran, to insure him protection on his perilous raids.

Years ago one of the London illustrated periodicals gave a full-length portrait of one of these mountaineers, entitling it "the last of the Zeybecs," but the race is not yet extinct, as can be proved by any one who ventures into the recesses of the Tmolus or Messogis.

In the morning Mr. Ramsay felt so much indisposed that he decided to return to Smyrna by the first train. Having despatched him under the safe guidance of Kara Ali to the station of Sultan Hissar, Mr. Purser and I started for the Meadow with an escort of Zeybecs, all armed, some on foot in front, seven or eight on horseback behind, with mounted servants bringing up the rear.

On our way to the opposite half of the village we crossed the torrent by a narrow bridge of planks. Here the horse of one of the Zeybecs, who was leading it, suddenly pulled the end of the bridle out of his hand and fell backwards upon a shelf of rock, many feet beneath, but, being saved by his massive saddle, the beast managed to scramble out of the stream with scarcely a scratch. We followed the upward course of the ravine by a rugged path worn by the charcoal burners across the mountain range. The slopes on either hand were shaded by

young oaks, and the torrent between them fretted its way among rocks of grey limestone, white marble, or glittering schist. At a spot where the path was narrowest, we encountered a train of horses, laden with charcoal, and driven by grimy Bulgarians. In the attempt to pass, the leading horses of our party lost their footing, Mr. Purser was thrown to the ground, with Babà the Zeybec upon him, but the accident fortunately resulted in bruised instead of broken limbs. The path indeed was in many parts dangerous, especially when it wound round the heads of the little gullies, which fed the main stream, and kept the narrow path moist and slippery, just where a false step would have precipitated beast and rider into a rocky chasin.

The woods we were traversing bore abundant traces of the havoc made by the carbonari. Here they were felling trees with a dexterity which our own grand old wood-cutter might have envied: there they were trimming them into logs, or stacking them on the steep hill side, or covering the stacks with earth, from which the smoke was sullenly escaping in blue wreaths. In a few places we observed a cleared spot, sown with barley, or planted with walnut or cherry-trees. But of habitations, after leaving Malagatch, we saw none.

After an ascent of some two hours and a half we emerged from the ravine and exchanged the wooded slopes for grassy downs, thinly studded with venerable Spanish chestnuts, which reminded me that the name given by the Turks to the Messogis chain is that of Kestaneh Daglı—the "mountain of chestnuts"—which tree is said to abound throughout the higher regions of this range. From a spot called Dikeli Tash, or "Upright Stone", we looked southward into an adjoining Déré, running almost parallel to that through which we had ascended; and far away in the opposite direction, to a lofty snow-capped chain of mountains, which I recognised as the Tmolus, under whose shadow I had explored the tombs of the Lydian kings in the winter of 1868-69, and again, with the Tenyle of Cybele at Sardis in the spring of 1882.

An hour and a half over these downs, and the Meadow we were seeking, called Ovajik by the Zeybecs, lay beneath us—a green plateau on the northern verge of the Messogis, just where the

mountain sinks abruptly to the wide valley or plain of the Caster. The plateau was apparently about three miles long, by half that in width, in parts somewhat marshy, in others showing a gravelly soil, mixed with quartz, and here and there cultivated with corn or fruit, inclosed by fences. We crossed it to a clump of lofty elms, at the very brow of the height, where a deep ravine opens, leading the eye down to the Caster valley. Here stood a low shed now abandoned, but an old Moslem cemetery at its side showed that the side had at one time been peopled.

This spot commands a magnificent view over the Caster plain, bounded by the grand serrated range of the Tmolus, one conical peak towering in the north, with another more to the east still capped with snow, though May was near its close. The plain beneath was hazy with mist and in parts thrown into deep shade by heavy clouds, so that it was not easy to distinguish the objects within our range of vision; but a ray of sunshine now and then breaking through the clouds, brought some features of the scene into bright relief—a tower, a village, or the glittering bends of the Caster, as it wound through the plain. The deep ravine at our feet carried the eye down to the town of Boudemia amid its fig-groves, which yield some of the choicest fruit that Smyrna exports. Farther out in the plain lay Thyra (alias Tyra or Tireh) and Baidyr, flourishing centres of agricultural industry, now connected by railway with the port of Smyrna, but neither of them visible to us from this point, though Eudemish was distinguishable on the further side of the plain, together with the remains of the ancient Hypepa on the lower slopes of Tmolus.

"late riget arduus alto

Tmolus in adscensu; clivique extensus utroque
Sardibus hine, illine parvis finitur Hypæpia."

OVID., *Met.*, II, 150.

From a higher point on the Messogis somewhat more to the east, we obtained a new and better bird's-eye view of the country at four feet. The Caster was seen flowing, not directly westward from the mountains which form the eastern boundary of the plain, as hitherto it has always been represented on the maps, but apparently from the southern foot of the Tmolus, taking at first a south-easterly direction, through a narrow valley

separated from the great plain by a low range of hills, which terminated in a sharp promontory at our feet. Doubling this promontory it assumed a north-westerly course as it entered the wide valley or plain to which it has given its name. The narrow river-basin is the Cilbian valley, called "Keller Ovassi" by the Turks, and the low range which bounds it on the west is doubtless the "Cilbiana Juga" of Pliny (N. H., v. 31) in which he tells us the Cayster takes its rise, although the statement, so far as I am aware, has not yet been verified. The inhabitants of this valley were distinguished in ancient times as the Cilbiani Inferiores et Superiores, each tribe of whom had a distinct coinage and must therefore have had a city where its money was coined. The Cilbian plain is also described by Strabo as extensive, well inhabited, and fertile. (XIII. 4. 13)

It was the great elevation we had reached which enabled us, by the bird's-eye view it afforded, to make this discovery of the upper course of the Cayster, the credit of which belongs entirely to Mr. Puser, who communicated his discovery to Mr. Kiepert, for the emendation of his maps of Asia Minor.

(to be continued.)

An Ancient Birdland.

For ages before its occupation by man, New Zealand swarmed with great wingless birds, which found here no carnivorous enemies, but an abundance of vegetable food. The Moas not only existed in vast numbers and for thousands of years, but had such diversity of form as to embrace no less than seven genera, containing twenty-five species—a remarkable fact which is unparalleled in any other part of the world. The commonest kinds in the north Island were only from two and one-half to four feet high. Those of the South Island were mostly from four to six feet tall, while the giant forms, reaching twelve and thirteen feet, were always rare. Immense deposits of Moa bones have been found in localities to which they appear to have been washed from the hills in tertiary times. Skeletons on the surface of the ground, with skin and ligaments still attached, have given the impression that these

birds have been exterminated in very recent years, but other facts point to a different conclusion. Traditions seems to show, according to Mr. F. W. Hutton, that the Moa became extinct in the North Island soon after the arrival of the Maoris in New Zealand—that is, not less than 400 to 500 years ago—and in the South Island about a hundred years later. The fresh-appearing skin and ligaments are supposed to have been preserved by unusually favorable conditions.

Geology of the Nile Valley.

At a recent meeting of the Geological Society of London a communication was read by Mr. Norman Tate from Messrs E. A. Johnson Pasha and H. Droop. Richmond entitled "Notes on the geology of the Nile Valley" in the course of which the authors state that the rocks on either side of the Nile from Cairo to Esneh are chiefly Eocene; south of this they are sandstones, probably Carboniferous, and they yield indications of coal. They extend to Assouan, where they meet the granite and basalt of that region.

A few miles to the south, sandstone again appears and save that it is occasionally broken by granitic dykes it extends to Wady Halfa.

The granite is intrusive into, and alters the sandstone, whilst the latter reposes upon the basalt and in some cases was deposited upon upstanding basaltic masses. To the east of Minieh, west of Assioutt unmistakable lavas appear. The paper concludes with a brief description of the minerals found in the sedimentary strata, and of the principal faults that occur in the district.

The Relationship of the Structure of Rocks to the conditions of their Formation.

By H. J. JOHNSTON LAVIS, M.D.

Of course the sheet of igneous magma may solidify at any part of its journey towards the surface, in consequence of—

- (a) Loss of heat from conduction away by the surrounding rocks.
- (b) Raising the acquired water to the mean temperature of the solution of silicates in which it is dissolved.

(c) By loss of heat in consequence of expansion with vesiculation during the extension of the fissure.

(d) By gradual escape of water in the form of steam or vapour through fissures so supplying fumaroli.

(e) By convection currents of waters forming Geysers or thermo-mineral springs.

It is a common fact that the water-bearing qualities of different rock strata are widely different, and we also know that an igneous dyke may traverse an alternation of more or less permeable strata. Where the supply of water was greatest, conductivity and other things being equal, there would take place the greatest amount of diffusion of that liquid through the igneous magma. Were this latter a perfect fluid, and non-viscous, the more aquiferous, probably lighter, part would soon diffuse itself in all directions, rendering the whole a homogeneous mass. We know, however, that all lavas are exceedingly viscous, especially the more highly silicious ones, and therefore such diffusion would take place very slowly. This would be aided by the upper part of the column being lighter, from that portion being placed under the more favourable conditions for absorbing water.

The more porous the strata the greater the tendency will there be for the conduction away of the heat of the magma, either directly or by the aid of convection currents of water, or by the conversion of the water into vapour, where pressure is so low as to permit it.

Extrusion or Eruption of the Igneous Magma into the Atmosphere.—If we suppose, simply for the sake of brevity of argument, the lava canal to be a tube of uniform size between the source of igneous matter and the surface (which, however, it never is), and that such a canal traversed rock strata of different permeability; then the magma enclosed in the tube would consist of a series of more or less saturated aquiferous strata, superposed on each other in the same order in which each part was exposed to a portion of the canal wall. Now, should a sudden exit of magma occur from the tube at its upper extremity, the expansion, or, in other words, eruption, would take place with a violence directly proportional to the amount of dissolved water, and the temperature of that por-

tion of the mass nearest the surface, at different periods of the eruption. The eruption will therefore lull or augment, as that portion, being expelled originally, occupied a more or less favourable site for the absorption of its contained volatile matter. The examples given at the end of this Paper seem to indicate that this departure from what is a normal type of eruption of a truly homogeneous magma is of rare occurrence. My experience in the field has been chiefly drawn from the basic volcanoes of Vesuvius and Roccamonfina (Leucite basalts), Etna, Iceland (basalts dolerites etc.) Mt. Vultura (Hälyn basalt), Mt. Nuovo (Phonolite), Ventotene and San Stefano of the Ponza group (Andesite), and Ischia (Trachyte). Lipari Islands (Rhyolites, Andesites, basalts, dolerites, etc.). Were the suppositions in the above case true, and were the entire chimney or canal completely emptied in each eruption, then we should expect every stratum of ejectamenta representing an eruption to be composed of a series of components alternating with each other in direct relation with the eruptive variations, and with the structure of the earth's crust beneath the volcano. Besides, in any one volcano, we should expect each stratum of pumice to be made up of analogous components to those produced during eruptions that preceded and followed it, indicating the same train of variations of activity, which is not the case. Geological evidence, so far as denudation has opened up to our examination the old remnants of igneous dykes and chimneys, leads us to conclude that igneous canals assume very irregular shapes, winding about where least resistance was offered to their extension, but nearly always assuming the form of a plate-like mass choking a fissure. Such fissure we know may have a horizontal extension of many miles. The opening or openings at the surface would be very localized, and therefore the upflow of the igneous matter would tend to take the form of a fan-shaped current with the point of orientation at and directed towards the exit. Under such conditions the order with which differently exposed parts of the fissure's contents reached the surface would be most complex, depending on a large number of collateral circumstances. The tendency will be to shade off sharp irregularities of composition, and render the magma more homogeneous.

The Main Varieties of Volcanic Outbursts.—Whatever type of activity the volcanic outburst may have taken, we have only so far discussed secondary variations therein, and it now remains to explain what is the acting cause in different varieties of eruptions.

It is necessary that we diverge from our train of argument to refer to some of the physical phenomena accompanying the relief from pressure of a superheated liquid. Sir G. B. Airy and Prof. Rankine (1) showed that in the explosion of a steam boiler the destructiveness was not due to the expansion of the steam already existing enclosed within it, but as soon as the pressure on the superheated water-contents diminishes, that liquid undergoes rapid and violent evaporation, until by such action the remnants are reduced to the normal boiling-point of the locality of the boiler. Mr. G. Biddle has demonstrated that, in a boiler containing steam and water at a pressure equal to four atmospheres, when the source of heat was removed, and the pressure suddenly relaxed, one-eighth of the whole liquid contents was immediately converted into the gaseous form. Prof. R. H. Thurston, (2) who has lately worked at the same subject, has shown that although the energy stored in the steam contained in a boiler is far in excess of that of the water at the same temperature, the amount, by weight of the latter, is often proportionally so much greater that it represents an enormous amount of stored energy. He showed, however, that as the temperature rose, the more the energy stored in the water approached that of the steam: at 50 lbs. pressure the ratio is 20 to 1; at 100 lbs., 14 to 1; at 500 lbs., 5 to 1; while at 7500 lbs. the two quantities become practically equal. At 60 lbs. pressure, 1 lb. of steam equal $\frac{1}{3}$ lb. of gunpowder; but at very high temperatures, at which steam and water are equal to each other, they rival gunpowder.

These facts are of extreme interest in relation to volcanic activity. At the enormous pressure and temperature that an igneous water-bearing magma may exist, the dissolved water equals, or exceeds in energy the same weight of steam or gunpowder. We also see that the crater-forming and eruptive

(1) *Phil. Mag.*, November, 1863.

(2) *Trans. American Soc. of Mechan. Engineers*, 1872; and *Journ. Franklin Inst.*, Dec., 1872.

power will be in direct proportion to the amount of superheated water existing in the magma; and crateriform hollows of ten miles in diameter are not difficult of comprehension. In fact, it seems somewhat astonishing that such excavations are not far greater, when we think of the terrific energy that may be stored beneath us in the form of such enormous dykes as those great masses of diabase in the region of the Hudson river. The great difference between the two conditions is, no doubt, that the water in the boiler is perfectly free to evaporate, whereas in an igneous magma it is molecularly scattered through the viscous mass, so that although the energy stored in equal quantities of water in either condition would be the same, the dispersion will be spread over a longer time in the case of the paste, due to retardation of escape in consequence of viscosity.

In the author's recent researches on the past and present eruptive phenomena of Vesuvius (1) certain important facts were brought out which it has been possible to confirm in a large number of instances in other volcanoes. When this volcano is in a state of chronic activity, with short intervals between one eruption and another, the violence with which the ejections take place is small compared with what occurs after long periods of quiescence. Thus, for instance, during the building up of the old mountain, and again during the last two to three centuries, we find that a very large portion of the products consisted of continuous masses of lava, whereas in the great explosions that excavated the gigantic crater of the *Átrio del Cavallo*, and which, from the interstratification of vegetable soils, and denudation marks, are proved to have occurred at long intervals apart, are characterized by deposits of spongy pumice, with a total absence of anything but fragmentary products. But in the above case we have not only geological, but even historical, proof; for we know that at least for many centuries before A.D. 79 this volcano had been apparently extinct, and that in the great Plinian eruption we had nothing but spongy fragmentary varieties of its usual igneous rock. The eruptions that followed the Plinian one occurred at diminished intervals, and so the more did their products ap-

proach in structure that of the lava of chronic activity, until, in the tenth century, pumiceous materials formed no longer, at any rate as far as the *essential* ejectamenta go, the products of these eruptions. To take another example, the precedents and whole history of which is pretty well known, namely, Monte Nuovo. We find that the main mass of the mountain is built up of pumice in various stages of comminution; capped, or covered, by more compact and crystalline scoria, or lava, fragments, which were only ejected at the last, when the volcano tended to pass into the chronic condition. We also know that such volcanoes as Tomboro, Krakatoa, and others like them, after a long quiescence burst forth with an amount of violence sufficient to cause disturbances throughout our planet, and then produce ejectamenta that are always of pumiceous character.

(to be continued)

Tools of the Pyramid-Builders.

A two years' study at Gizeh has convinced Mr. Flinders Petrie that the Egyptian stone-workers of 4000 years ago had a surprising acquaintance with what have been considered modern tools. Among the many, tools used by the pyramid-builders were both solid and tubular drills, and straight and circular saws. The drills, like those of to-day, were set with jewel (probably corundum, as the diamond was very scarce), and even lathe-tools had such cutting-edges. So remarkable was the quality of the tubular drills and the skill of the workmen that the cutting marks in hard granite give no indication of wear of the tool, while a cut of a tenth of an inch was made in the hardest rock at each revolution, and a hole through both the hardest and softest material was bored perfectly smooth and uniform throughout. Of the material and method of making the tools nothing is known.

Maltese *Cæcilianellæ*.

A CONTRIBUTION TO THE STUDY
OF MALTESE LAND SHELLS

BY ALFRED CARUANA GATTO.

The only species of this genus mentioned in Dr. Caruana's Catalogue of the shells of Mr. Mamo's

(1) *Quart. Journ. Geol. Soc.*, January, 1884.

collection, in Cap. Feilden's and in Capt. Becher's lists of Maltese Land Shells is *Acicula acicula* Mull, about which Capt. Feilden notes:—"It is not a common species in Malta, and it is found in small numbers on the old line of fortification near Corradino."

Prof. Issel mentions two *Cæcilianella* but he does not give their specific names, limiting himself to say that one of them, which he had collected near Har Dalam, belongs to the *C. acicula* group; of the other species observed by him in the collection of shells in the Public Library he says nothing.

Benoit and Gulia in their Catalogue ignored this genus.

Being uncertain as to the exact determination of the specimens of *Cæcilianella* collected by me, I sent them first to Prof. Pollonera of Turin who recognized *C. Stephaniana* Benoit and a new species which I named for him *C. Pollonerae*.

On the further examination of fresh specimens I thought that the one that had hitherto borne the name of *C. acicula* Mull was altogether a new species, so I named it *C. Melitensis* and I sent it for approval to Prof. Dr. C. Westerlund of Ronneby together with the whole lot of my *Cæcilianella*. Prof. Westerlund acknowledged the correctness of the determination of the species sent to him and discovered one more, which he very kindly named for me *C. Gattoi*. At my request he favoured me also with their diagnoses.

The *Cæcilianella* therefore till now collected in Malta are as follows:—

1—*CAECILIANELLA, STEPHANIANA* BENOIT. — A few dead specimens were collected in Mr. H. Vassallo's garden at C. Attard.

2—*C. GATTOI*, WESTERLUND, *n. sp.*

Testa cylindrico turrita, nitida, diaphana, alba, sat distanter costulato-striata, spira a medio teste longe attenuata; turrito-conica, obtusiuscula; anfr. 6½, convexiusculi, superi tres sat angusti, tres ultimi sat alti, penultimus parum antepenultimo major, ultimo ad aperturam duplo brevior, ultimus longus, infra attenuatus; apertura longa, angusta, sursum longe attenuata, basi rotundata, fere longitudine spiram æquans, pariete et columella brevi basi truncata in linea fere recta jacentibus, margine anteriore verticali, media producta. Long. 6½, lat. 2 mm. apert. long. 3 mm. (Westerlund descr.)

A few specimens were collected in the same locality with No. 1 under stones in Uied Encita, and some others are to be seen in the Public Library.

3—*C. MELITENSIS*, MIHL. *n. sp.*

Testa subsulcata, fere a basi lente attenuata, obtusiuscula, hyalina, striatula; anfr. 6, vix convexiusculi, sat lente accrescentes, penultimus antepenultimo parum longior, ultimo subæqualis; sutura obliqua, marginata; apertura tertiam partem longitudinis totius subæquans, anguste ovata, basi rotundata, sursum breviter acuminata, pariete subrecte descendente, columella sat forte arcuata, infra truncata basin non attingente, margine exteriori valde antrorsum arcuato producta. Long. 3½, lat. 1½ mm. (Westerlund descr.)

This species is more frequent and is to be found in flowerpots, gardens, yards etc. A good number of specimens some of which were living has been furnished me by my friend Dr. Ed. Calleja from flowerpots on his terrace. But notwithstanding, it cannot be called a common species. Till now it has been known as *C. acicula* Mull and it is thus labelled in Maltese collections.

4—*C. POLLONERAE* MIHL. *n. sp.*

Testa sulcata, a basi lente attenuata-elongata, obtusiuscula, dense striata; anfr. 7, vix convexiusculi, supremi duo minuti, ceteri elongati, penultimus et ultimus æquales, antepenultimo paullo longiore; sutura perobliqua, marginata, apertura quartam partem longitudinis totius attingens, extus subnervicalis, inter parietem convexiusculum et columellam tenuem brevem, infra vix truncatam, forte sinuata, margine exteriori toto fortiter antrorsum arcuato. Long. 4½, lat. 1 mm. (Westerlund descr.)

Found among the specimens of *C. melitensis* given by me by Dr. Calleja. Two other specimens of this distinct and elegant species were found by me in the yard of a house in Valletta.

I have directed my attention to *Cæcilianella* only lately and I doubt not but that further researches will lead to the discovery of more species.

As to the figuring of the new forms I trust to be able to do that in my general Catalogue of our land and freshwater molluscs.

The Sahara.

The Sahara is an immense zone of desert which commences on the shores of the Atlantic Ocean, between the Canaries and Cape de Verde, and traverses the whole of North Africa, Arabia, and Persia, as far as Central Asia. The Mediterranean portion of it may be said roughly to extend between the 15th and 30th degrees of north latitude.

This was popularly supposed to have been a vast inland sea in very recent times, but the theory was supported by geographical facts wrongly interpreted. It has been abundantly proved by the researches of travellers and geologists that such a sea was neither the cause nor the origin of the Libyan Desert.

Rainless and sterile regions of this nature are not peculiar to North Africa, but occur in two belts which go round the world in either hemisphere, at about similar distances north and south of the equator. These correspond in locality to the great inland drainage areas from which no water can be discharged into the ocean, and which occupy about one-fifth of the total land surface of the globe.

The African Sahara is by no means a uniform plain, but forms several distinct basins containing a considerable extent of what may almost be called mountain land. The Hoggar Mountains, in the centre of the Sahara, are 7,000 feet high, and are covered during three months with snow. The general average may be taken at 1,500. The physical character of the region is very varied. In some places, such as Tiout, Touat, and other oases in or bordering on Morocco, there are well-watered valleys, with fine scenery and almost European vegetation, where the fruits of the north flourish side by side with the palm tree. In others there are rivers like the Uied Guir, an affluent of the Niger, which the French soldiers, who saw it in 1870, compared to the Loire. Again, as in the bed of the Uied Rir, there is a subterranean river, which gives a sufficient supply of water to make a chain of rich and well-peopled oases equal in fertility to some of the finest portions of Algeria. The greater part of Sahara, however, is hard and undulating, cut up by dry watercourses, such as the Igharghar which descends to the Chott Melghigh,

and almost entirely without animal or vegetable life.

About one-sixth of its extent consists of dunes of moving sand, a vast accumulation of detritus washed down from more northern and southern regions—perhaps during the glacial epoch—but with no indication of marine formation. These are difficult and even dangerous to traverse, but they are not entirely destitute of vegetation. Water is found at rare but well-known intervals, and there is an abundance of salsolaceous plants which serves as food for the camel. This sand is largely produced by wind action on the underlying rocks, and is not sterile in itself—it is only the want of water which makes it so. Wherever water does exist, or artesian wells are sunk, oases of great fertility never fail to follow.

Some parts of the Sahara are below the level of the sea, and here are formed what are called *chotts* or *sebkhas*, open depressions without any outlets, inundated by torrents from the southern slopes of the Atlas in winter and covered with a saline efflorescence in summer. This salt by no means proves the former existence of an inland sea. It is produced by the concentration of the natural salts, which exist in every variety of soil, washed down by winter rains, with which the unevaporated residue of water becomes saturated.

A year's insect-hunting at Gibraltar.

BY JAMES J. WALKER, R.N., F.E.S.

II.

A fairly good road (for Spain) leads from the beach through the Village of Campamento to the small and clean town of San Roque, rather prettily situated on the top of a low hill about six miles from Gibraltar. Beyond this the country, hitherto bare and treeless, except for a few gardens and a grove of blue gum trees at Campamento, improves very much. Two large plantations of the stone pine (*Pinus cembra*) may be mentioned as especially good collecting ground, and in the early spring the country is one sheet of beautiful wild flowers, species of *Helianthemum* and *Cistus* predominating. Just beyond the "second Pine Wood," at about nine miles from the Rock, commences the "Cork Woods," the great hunting ground

of the district, which extend for many miles along the valley of the Guadarranque and the adjoining hillsides. These woods are chiefly composed of the *Quercus suber* (cork oak) and *Q. lusitanica*, with a sprinkling of ash; and, where the ground is marshy, with alder trees of unusual size, and a very varied undergrowth. Most of the cork trees have a very curious appearance from the bark being stripped off to a height of ten or twelve feet from the ground: a good deal of the timber is recklessly cut down to be converted into charcoal, but it is rare to find a log or stump in good condition for working at. This wood never failed on every visit (and I walked out there at least weekly throughout April, May, and June) to produce something new and interesting to me; the furthest point reached on foot being the "Long Stables," 14 miles from the Rock, which is thus the limit of my collecting.

The local list of butterflies is not at present a large one, consisting of 55 species, including the specimen of *Danaus Plexippus*, L.,* recorded in Ent. Mo. Mag., 1886, vol. xxiii, p. 162: and of these, 30 species, indicated by an asterisk, have been observed by me on the Rock itself. Some 900 species of *Coleoptera* have as yet rewarded my efforts, but this Order is evidently far from exhausted here, as I never fail to find one or more additions in every walk in the country: the other Orders of insects, especially the *Hemiptera* and *Hymenoptera*, appear also to be very well represented.

At the time of my arrival here, on the 20th October, 1886, the aspect of the Rock presented a curious mixture of autumn and spring, some recent copious showers of rain having caused the fresh green grass to sprout up everywhere, with a good number of flowers in favourable spots, while, at the same time, the leaves of the plane and poplar trees were brown, withered, and falling. Insects were by no means numerous on the wing, as besides those butterflies already mentioned as existing all the year round, only old specimens of *Papilio Machaon*,* *Satyrus Megera*,* *Lycena betica*, L.* and *Telicanus*, Hb.,* *Spilothyrus alcea*, E.,* and *Macroglossa stellatarum*, were to be met with. A male *Cherocampa celerio* in very fine order was brought to me on November 12th, and a few *Noctue* were taken on ivy bloom, which,

however, does not appear to be nearly as attractive as at home.

In *Coleoptera* a great deal more work was to be done, and, during the months of November and December, I obtained a large number of species: my usual hunting ground being the lower slopes of the Sierra Carbonera and the open country between these hills and Campamento, easily reached in little more than an hour's walking. As an instance of the abundance of beetle life here, I may mention that 100 species were not unfrequently taken in an afternoon's work (on one day I bottled 135 species,) and from 30 to 40 were sometimes shaken out of a single tuft of grass. Turning stones was also very remunerative, three *Cavaoi* (*rugosus*, F., *melancholicus*, F., and another species) being of frequent occurrence, as well as *Scarites hespericus*, Dej., *Siagona Jenissoni*, Dej. (a most active creature), and *Aptinus displosor*, Duf. When a stone, on being raised, revealed half a dozen or more of the latter insect, as often happened, the noise of the explosions of these large and powerful "Bombardiers" was quite startling, and the volatile liquid they discharged was strong enough to cause a distinct sensation of burning in my fingers, which were deeply stained brown for several days afterwards. At least five species of *Brachinus* were present, the little pallid *B. testaceus*, Ramb., and *scelopeta*, F., being the most noteworthy: with the latter *Drypta dentata*, Rossi, occurred very copiously in damp places. *Callistus lunatus*, F., and the beautiful *Lebia pubipennis*, Duf., were but seldom found, but the usually rare *Singilis bicolor*, Ramb., was quite plentiful, with two species of *Platytarsus*, and of *Cymindis*, *Licinus silphoides*, F. (variety), *Masoreus aegyptiacus*, Dej. (in sandy spots), *Chlaenius chrysocephalus*, Rossi, and *azureus*, Dej. (rare), *Orthomus hispanica*, Dej., *Percus politus*, Dej., and the elegant *Feronia crenata*, Dej., among others. The large and fine *Ditomus cephalotes*, Dej., occurred rarely near San Roque; two species of *Aristus* were not unfrequent, with the active little *Apotomus rufus*, Rossi, under almost every big stone. Many interesting forms of *Pselaphidae* and *Scydmaenidae* were to be seen, on close scrutiny, clinging to the under-sides of the stones with sundry *Staphylinidae*, the rare and curious *Ctenomastax Kiesenwetteri*, Ktz., among them; as well

as two species of the singular genus *Cossyphus* (*Dejeani*, Brême, and *incostatus*, Lap.), *Calcar elongatum*, Hbst., *Adelostoma sulcatum*, Dup., the queer little linear *Boromorphus tagenoides*, Luc., *Litoborus planicollis*, Waltl, and two species each of *Stenosis* and *Dichillus*. All these latter were to be found in the tufts of grass, with a host of other small beetles, chiefly *Rhynchophora*: among these may be mentioned *Leucohimatum elongatum*, Er., *Dermestes sardous*, Kust. *Melyris granulata*, F. (abundant), two species each of *Spenoptera* *Aphanisticus*, *Trachys*, and *Troscus*, some eight or ten *Anthici*, *Scleron armatum*, Waltl (in plenty), various species of *Ptinus*, *Acalles*; *Gymnetron*, *Pachytichius*, *Baris*, *Rhytirhinus*, &c., with occasional examples of *Cleonus excoriatus*, Gyll., *Rhytideres plicatus*, Ol., the gaudy black and scarlet *Lithonoma limbata*, F., *Platynaspis villosa*, Fourc., and a *Thorictus*. Three or four brilliant green and coppery-red *Chrysomelæ* abounded on the wild mint, and the beautiful *C. americana*, L., was to be found in plenty on *Lavandula stoechas*. Walking about in the roads *Brachycerus undatus*, F., and a smaller species were not rarely seen, and the *Coprophaga* were represented, in their usual habitats, by the big black *Copris hispana*, L., *Geotrupes Hofmannseggii*, Frm., *monus*, Oliv., and *hypercrita*, Serv., *Bubas bison*, L., *Onthophagus taurus*, L., and others of the last genus, all common.

In and about small pools of water were found various *Dyschirii* and *Bledii* *Georyssus*, sp., *Parnus hydrobates*, Kies., and a fair number of the smaller *Hydradephaga*. Among the wood-feeders the tiny *Hypoborus ficus*, Er., abounded in the small twigs of fig trees, burrowing under the bark, and an old mulberry stump at Linea was full of *Liparthron mori*, Aubé. Hibernating under the loose flakes of bark on *Eucalyptus* trees at Campamento, were swarms of common beetles; among them the pretty little *Cardiophorus 6-punctatus*, Latr., in clusters of a dozen or more. Small puff balls yielded a good supply of *Lycoperdina bovis*, F.

(to be continued.)

The Serpents and Chelonians of Italy.

BY

PROF. LORENZO CAMERANO.

At a recent meeting held at Turin by the Royal Academy of Sciences, a work which I had written

on the above subject was approved for printing. This work brought to an end my study on Italian Erpetology which I had begun in 1883 with the monograph of the *Anfibi Anuria*, continued in 1884 with that on the *Anfibi urodeli*, in 1885 with the monograph on the *Sauri*, and finally in 1888 with that of the *Ophidi*: part I. *Viperidæ* (1).

The Italian ofidians of the genus *Colubridi* are as follows:—

Fam. COLUBRIDÆ:

- 1° *Coelopeltis monspessulana* (Herm.);
- 2° *Tropidonotus natrix* (Linn.);
- 3° *Tropidonotus natrix* sub. spec. *persa* (Pallas);
- 4° *Tropidonotus natrix* sub. spec. *Cetti* (Gené);
- 5° *Tropidonotus tessellatus* (Laur.);
- 6° *Tropidonotus viperinus* (Latreille);
- 7° *Elaphis quateradiatus* (Gmel.);
- 8° *Zamenis gemonensis* (Laur.);
- 9° *Periops hippocrepis* (Linn.);
- 10° *Callopeltis quadrilineatus* (Pallas);
- 11° *Callopeltis longissimus* (Laur.);
- 12° *Coronella austriaca* sub. spec. *Fitzingeri* (Bon.);
- " " " " " [var. *conjuncta* (Nob.);
- 13° *Coronella girondica* (Daudin).

It will be seen from these memoirs that the same fauna is to be found in Italy as in Central, Eastern, and Western Europe, and Northern Africa. No species of the Ophidians is indigenous to Italy. Italy, however, possesses some species of its own, as, the *Tropidonotus natrix* sub. spec. *Cetti* (Gené) of Sardinia and the *Coronella austriaca* sub. spec. *Fitzingeri* (Bonap.). It happens with the Ophidians that which has already been observed with regard to other groups of reptiles, some of the species having a more extensive geographical distribution offers in Italy special modifications distinguished with names of subspecies.

The Italian chelonians can be divided into three groups viz:—those that may be considered as native; those of western origin, and others imported into Italy at a comparatively late time.

SPECIES OF NATIVE ORIGIN:

- 1° *Emys orbicularis* (Linn.);
- 2° *Testudo graeca* (Linn.);
- 3° *Thalassochelys caretta* (Linn.).

(1) *Memorie della R. Accademia delle Scienze. Ser. II, vol. XXXV, XXXVI, XXXVII, XXXIX.*

SPECIES OF WESTERN ORIGIN:

- 4° *Chelone mydas* (Linn.);
 5° *Dermochelys coriacea* (Linn.).

IMPORTED SPECIES:

- 6° *Testudo ibera* (Pallas);
 7° *Testudo marginata* (Schoepff).

The Depths of the Mediterranean and Black Seas. (1)

By RICHARD BEYNON, F.R.G.S.

Isolated as it is from the great water masses of the globe, the Mediterranean—with its off-set, the Black Sea—may be regarded as a provincial sea. The oceanic circulation of the North Atlantic sweeps past its narrow entrance unheeded. The great tidal wave is effectually debarred by the convergence of the African and European coasts from influencing the tidal phenomena of the Mediterranean, and the same cause, aided by the near approach of the strata underlying the Straits of Gibraltar to the surface, precludes the possibility of the chill waters that ever roll equatorwards along the sea floor finding their way into the vast inland sea under discussion. The geographical limits of the Mediterranean are well known, but its true geological boundaries by no means coincide with these. Instead of terminating to the westward at the Straits of Gibraltar, the sea is really continued some 50 miles into the Atlantic, for the shoal water which separates the line of coast between Tangier and Ceuta from the opposite shores of Spain extends westwards to that distance. Here the shallow ridge terminates, and the sea bed rapidly falls into the depths of the Atlantic.

The proximity of the island of Sicily to Cape Bon suggests the very natural division of the Mediterranean into an eastern and western section. Taking the western portion, we find that at its two lateral extremities it is separated by a shallow ridge from the Atlantic on the one side, and the deep waters of the Eastern Mediterranean on the other. The depths of water obtaining on these shallows approximately coincide. The deepest sounding obtainable on the ridge between Cape

Bon and Sicily is under 200 fathoms, while the maximum depth in the vicinity of Gibraltar is 180 fathoms.

The shoal water which commences some 50 miles to the westward of Gibraltar is really continued 120 miles to the eastward of Point Europa, almost to the shores of Alboran Island.

If we regard as continental, islands that are separated from the mainland by depths not exceeding 100 fathoms, then Alboran must be classed as an oceanic island, for on all sides it is surrounded with water of 400 fathoms and upwards in depth. The Balearic group present most peculiar features. Instead of forming one group, as their juxtaposition would seem to imply, they make two. Iviza and Formentara are separated from Majorca, Minorca, and the Spanish coast by soundings of 300 fathoms. The two last named islands have a channel of 50 fathoms between them, and to the eastwards of Minorca the sea bed has a steep gradient until, 30 miles from the Balearic group, a depth of 1400 fathoms is encountered. A comparatively slight upheaval of the Mediterranean bed would suffice to connect Corsica and Sardinia, for the Straits of Bonifacio are of little depth. Shoal water, too, connects this group with Elba and the mainland of Italy. The shallow channel which extends from Cape Corso, *viâ* Elba, to the coast of Tuscany has an average width of from 15 to 20 miles, and nowhere along it can soundings of a greater depth than 50 fathoms be obtained.

We now come to the easterly boundary of the western portion of the Mediterranean Sea.

From Cape Passaro, at the south-easterly corner of Sicily, a bank with 300 fathoms of water over it extends to the opposite shores of Tripoli, while a somewhat similar ridge, with a lesser depth of 200 fathoms, connects the other extremity of the island with Cape Bon. Between these two banks a deep water gully runs, with an average depth of 600 to 700 fathoms.

With regard to the deep water areas of the western section of the Mediterranean, a fairly uniform depth, ranging between 1200 and 1600 fathoms, is maintained between Marseilles and Algiers, while the deep water lane extending from Naples to Sardinia admits of soundings of 1500 to 2000 fathoms,

These are the more salient features revealed by soundings taken in the western portion of the Mediterranean. Scientific research, however, has added much to our knowledge of the eastern section during the past few years, and it is chiefly to Austria that progress in the study of the oceanography of this part of the Mediterranean is due.

Before the *Pola* expedition the generally received greatest depths obtained in the Mediterranean were 2040 fathoms in the western section and 2150 in the eastern. The latest results, however, show that deeper soundings are obtainable. On the 28th July, 1891, the *Pola* found the depth of 2406 fathoms, and a few miles further to the eastward 2236 fathoms, both of which depths exceeds those mentioned above. The exact position of this, the deepest spot yet discovered, is $35^{\circ} 44' 20''$ north lat., and $21^{\circ} 44' 50''$ east long., or, roughly speaking, about 50 nautical miles south-west of Matapan. Very properly the Austrian Hydrographical Board have determined to perpetuate the record of their nautical find by assigning to this deep-water spot the name of *Pola Deep*. This discovery will necessitate the removal of the deepest part of the Mediterranean considerably eastwards from its present position on our maps. Another deep-water area explored by the *Pola* was that lying between Candia and Alexandria, the depths ranging from 1810 fathoms, some 20 miles south-east of Grandes Bay, to 1322 fathoms within a short distance of Alexandria. The serial temperatures taken by this expedition coincide in the main with those obtained during previous researches.

(to be continued.)

NOTES AND NEWS.

The Reale Accademia delle Scienze di Torino has suffered a great loss by the death its Vice-President Prof. G. Flechia.

A commission has been appointed by His Excellency the Governor of Malta for the purpose of inquiring into the causes of, and the remedies for the diseases of the Maltese vines to which we drew attention in our last issue.

A sharp shock of earthquake was felt on the 21st. ultimo in Valletta and the surrounding casals at 3.10 p. m.

During a lecture at the Royal Institution, Prof. Dewar caused both liquid oxygen and liquid air to be drawn to a magnet. He created a sensation by handing the chairman a wine-glass of liquid air — a clear transparent substance, condensed at a temperature of 187°C below zero, but capable of burning the flesh like red-hot iron.

We learn from *Nature* that Mr. Thomas Hanbury has presented the Botanical Society of Genova with a rich collection of vascular plants which was made by the late Prof. Wilkomm of Prague. It comprises as many as 14,472 species the greater number being European or from the adjacent districts of Asia and Africa. It is especially rich in plants of the Spanish peninsula and includes most of Wilkomm's type specimens.

The July number of *Natural Science* contains among other matter the following articles:— The Story of Olenellus by Prof. G. A. J. Coles, F.G.S. The Physical Features of the Norfolk Broads by J. W. Gregory, B.Sc., F.G.S. The Evolution of the Flat Fish by Prof. A. Giard. Agricultural Museums by J.H. Crawford, F.L.S. Amber and Fossil Plants by A. C. Seaward, M.A., F.G.S.

We are in receipt of the 1892 edition of the Scientists' International Directory containing the names, addresses, special department of study etc., of professional and amateur naturalists, chemists, physicists, astronomers, etc. in all parts of this world. To those who are anxious to increase their collections, or compare notes with other naturalists it is an indispensable publication. It is edited by S. E. Cassino, Exchange Buildings, Boston.

In an article contributed to the "Comptes Rendus" describing an excursion to the

"Shotts" of Algeria M. Vuillot observes that there are several districts between Sif-El-Ashana and El-Awina that are situated above the sea-level.

This is of special interest as Commander Roudaire has stated that the whole of this region lies below sea level.

Some of the effects of the absence of light upon animal life were strikingly revealed, not long ago, on the reopening of an old mine near Bangor, Cal. In a dry slope connecting two shafts, one of the explorers was astonished and startled to find a number of flies that were perfectly white, except the eyes, which were red; and directly afterward he killed a pure, white rattlesnake. The animals had lived in the dry passages, where they had been supplied with air but not with light. It is supposed that the flies were the offspring of some that had been imprisoned by the partial filling of the mine with water about thirty years ago, and that the snake, when quite young, had been washed down in a rain. A few of the flies were exposed to light in a glass case, and resumed the colors of ordinary house flies within a week.

According to statistics recently collected by the German Forestry Commission the maximum of life attained by the most common of the forest trees is thus given. The pine-tree is assigned from 500 to 700 years, the silver fir about 425 years, the larch 275 years, the red-birch 245 years, the birch 200 years, the ash 170 years, the alder 145 years, and the elm 130 years.

The curious organs of the throat known as the tonsils—whose function has been a source of much perplexity—are believed by Dr. Lovell Gulland to be glands in which the white corpuscles are formed. It is these corpuscles that are constantly at war with disease germs in the blood. Some of the white corpuscles, if Dr. Gulland's novel theory be true, are stationed as sanitary sentinels to guard the entrance to the throat, lungs and stomach, while the corpu-

cles circulating in the blood act as an army to attack the germs that succeed in entering the body. Another physician contends that the vermiform appendix, apparently useless organ and one that often gives serious and fatal trouble, is also a gland, and that it acts as an intestinal tonsil.

The experiments that have hitherto been made for the purpose of ascertaining the speed of fishes have not been attended with very satisfactory results. The comparatively low intelligence of this class of animals makes it difficult to direct them. They rarely swim in anything approaching to a straight line, and experiments upon them give only approximate results. Pike in pursuit of their prey seem to dash through the water, and salmon and trout move almost as quickly. The Spanish mackerel, with its smooth, cone-shaped body, is among the swiftest of fishes, and for speed only finds a parallel in the dolphin. There is a great similarity in shape between these two, and both cut the water like a yacht.

If the bed of the Atlantic were drained, a geographical writer tells us, it would be a vast undulating plain, with a middle plateau parallel to the North American coast, and another plateau connecting this central one with northeastern South America. The Atlantic is thus divided into three great basins. The tops of the sea plateaus are two miles below a sailing ship, and the deepest parts of the basins almost five miles. These plateaus are whitened for thousands of miles by a minute species of creamy shell, which cover their sides like snow-banks. In the deepest parts the sea bottom is red in color, strewn with volcanoes and meteoric particles, and the deeply incrustated bones of whales, sharks and other sea monsters. In the black and silent waters of the abysses, lighted only by phosphorescent animals, vegetable life is nearly absent, while the scanty animal life is nearly absent, while the scanty animal life consists of a few strange species which only in earlier geological ages can have been common near the surface.

The cause of our old friend the sparrow is now given up by so high an authority as Miss Ormerod, the entomologist, who, in a letter to Earl Cathcart, has declared herself unequivocally on the side of the Sparrow Clubs. Among farmers there has never been much hesitation on this subject. As to the depredations of rooks they are pretty equally divided. Miss Ormerod is of opinion that in the case of the corvidæ much depends on weather, state of land, and crops, but as regards the much-vexed question of the sparrow she declares that, whatever it may eat in town, it is in the country, to her personal knowledge, a cause of fearful loss. This is not only by its raids on the cornfields, but by driving away the swallows and martins, which are amongst the first-class of our insect protectors. "Should the matter" (says Miss Ormerod) "be brought forward, I have a large amount of evidence in my hands as to the absolute curse that this bird is (in its fostered condition) to British agriculture."

The enormous mortality every year among the native population of India from snakebites has led the authorities to seriously consider the advisability of adopting means whereby the evil may be mitigated.

A new and improved snake house to contain specimens of the principal poisonous reptiles of the country has been established in the Calcutta Zoological Gardens, and it is proposed to add a laboratory for inquiries bearing upon the pathology of snake-bites, and related subjects, and for experimental tests of alleged remedies.

As the close of the world's most wonderful century draws near, speculative minds naturally wonder how long our civilization can continue, and whither it is tending. Much of our boasted progress is lamentable extravagance, a mode of living gained at a frightful expenditure of resources. Fuel is our dependence, and its consumption is accelerating so rapidly through our eagerness to move fast that the supply stored in past

ages must inevitably be exhausted in a few generations. What then? It is quite possible that some way of utilizing the sun's wasted energy may be found, and may give ample power and heat for innumerable prodigal generations to come. Or it may be that humanity is destined soon to return to early primitive conditions. In any event as Sir Robert Ball declares, to future historians "the few centuries through which we are now passing will stand out prominently as the coal-burning period."

In a recent number of Petermann's Mitteilungen, Dr. A. Supan points out that the old hypothesis that the various seas of Europe are situated at different levels is no longer tenable. From statistics that have been collected at 33 stations in the Adriatic, Mediterranean, Atlantic, North Sea, and Baltic the heights differ but slightly from those at Marseilles, so that, for practical purposes, the sea-level around Europe may be considered as being the same.

To Correspondents:—

Citris:—See the "Mediterranean Naturalist" Nrs. 6, 11, and 12. Vol. I. Soap and water sprayed over the leaves is an excellent preventive.

Lia:—Your grapes are evidently affected by the *Erinosa*. Sprinkle the leaves with powdered sulphur.

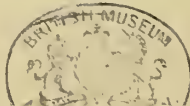
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Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

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BY

REV. PROF. G. HENSLAW, M.A., F.L.S. etc.

Mr. Cooke's paper on the discovery of phosphatic nodules in Malta has suggested to me that the readers of the *Mediterranean Naturalist* might be interested in a brief account of the original discovery of phosphate nodules by my father, the Rev. J. S. Henslow, late professor of Botany in the University of Cambridge, to whose scientific knowledge was due the commencement of this most important branch of agricultural industry.

The first agricultural chemist to suggest the use of superphosphate of lime was Prof. Liebig, who in 1839 proposed the employment of bones for such a purpose. (2) He returned to the subject in 1843, strongly advocating the more general use of phosphates. "A field," he says, "in which phosphate of lime, or the alkaline phosphates form no part of the soil, is totally incapable of producing grain, peas, or beans" (3) Again, he declares that "if a rich and cheap source of phosphate of lime were open to England, there can be no question that the importation of foreign corn might be altogether dispensed with after a short time." He here (p. 176) speaks in allusion to the "coprolites" (4) discovered by Dr. Buckland in 1842. The enthusiastic chemist concluded his letters with the following remarks:—"What a curious and interesting subject for contemplation! In the remains of an extinct animal world, England is to find the means of increasing her wealth in agricultural produce, as she has already found the great support of her manufacturing industry in

(1) Originally appeared in "*The Leisure Hour*," 1862.

(2) *Organic Chemistry of Agriculture*, p. 184, 1840.

(3) *Familiar letters of Chemistry*, 1843.

(4) *Fossil excrements of Saurians*, occurring in the Lias near Clifton, containing about 18 p. c. of phosphate of lime.

the remains of a *vegetable* world. May this expectation be realised, and may her excellent population be thus redeemed from poverty and misery!"

He little suspected that in the following year, 1843, his hopes would begin to be realized; which by the year 1862, would be represented by an annual consumption of superphosphate of lime, made from phosphate nodules, so called "coprolite," to the amount of 72,000 tons, at an expenditure of £ 360,000. (1)

Previous to Dr. Buckland's discovery, guano had begun to be imported (1841) from islands in the south Pacific ocean, where it forms a stratum many feet thick, being the accumulation for ages of the excrement of innumerable sea-fowl. It was at that time used as a manure with great advantage on the coast of Peru, where the soil is naturally very sterile. Its percentage of phosphate of lime in Guano is about 29. Its first trial in England (in Mr. Skirving's Nursery at Liverpool, upon grass and turnips) established its reputation as being far superior to any known manure; the price, moreover of its importation being only from 20s. to 25s. per cwt. By the year 1844 the application of Guano had become various and abundant.

Up to this period Liebig's speculations had not been realized. It was in the year 1843 that Prof. J.S. Henslow and his family were staying for a few weeks at Felixstow a village on the east coast; and although at that time generally condemned as a watering place, (2) yet it is seated in one of the finest bays in England with excellent and safe bathing. It possesses a maritime flora of much interest, and cliffs consisting of some of the most remarkable of our British Strata. On the north of Felixstow high cliffs face the sea, the lower and greater portion consisting of the lower Eocene beds "London Clay," a bluish gray, clay-bed crumbling under exposure to the atmosphere, unfossiliferous but abounding in septaria and nodular masses of stone, from one to three feet in diameter. Vast quantities of these are collected out at sea for the purpose of making "Roman" cement. A little flotilla of boats may often

be seen a mile or so out, dredging for these large "mackles" or compound crystals of selenite which also occur in the clay or well.

Superimposing the London clay is the "Red Crag," so called from its peculiar yellowish-red colour, due to the great prevalence of peroxide of iron. It is for the most part a sandy "shore" bed, abounding in vast quantities of rolled and water-worn organic remains. Numerous sharks teeth varying in size from half an inch to those of the great *Carcharodon Megalodon* so common in the Maltese rocks. Portions of whales' bones, especially the ribs, and the petrous tympanic bone of the ear are particularly common. (1)

He whole thickness of the sandy cliff is generally charged with broken fragments of shells the harder kinds, as *Fusus antiquus*, *Naticas* etc. being perfect but rolled. It is at the bottom or junction between the London Clay and Red Crag where the phosphate pebble-bed lies.

The nodules appear to have derived their origin from the London Clay, in which many were found by the late Mr. John Brown of Hanway, Essex; differing, however, from the former, in the absence of the peculiar dark-brown colour on the exterior surface, and from a bright yellow, colour being often disclosed in the interior by fracture.

Although this pavement of rolled phosphatic nodules lies at the bottom of the Red Crag, when this bed is in conjunction with the London clay; there is reason for suspecting that the true period of its deposition was at the close of the Miocene epoch for an anterior bed, known as the white or (mis-called) Coralline Crag (2) has on one occasion been found to overlie the phosphate nodules bed. At least this was the conclusion arrived at from a certain boring which passed through both

(1) So abundant were there "whales ears" that the Professor had at one time in his collection, upwards of 32 dozen! A description of them may be found in Owens British Fossil Mammalia. I would add that by carefully comparing about 400 specimens I found that excepting *Balcena affinis*, the other "species" were not distinguishable.

(2) What were supposed to be corals are now recognized as *Bryozoa*.

(1) *Midland Counties Herald*, Feb. 20, 1862.

(2) At that time there were only ten lodging houses built of wood. These were burnt down about 1850. Of late years Felixstow has been greatly enlarged and is now being rapidly extended.

the crags, which are seldom to be seen in contact. Moreover, the phosphate nodule bed contains the remains of terrestrial quadrupeds which were characteristic of the Miocene period, when England was continental and not submerged; such species of the genera *Hyaenarctos*, *Hipparion*, *Rhinoceros*, *Mastodon*, *Elephas*, *Tapiris*, *Cervus* etc. It may be here noticed that thanks to the commercial enterprise aroused by the value of the nodules, geology has thus, acquired a greatly increased knowledge of both land and marine fauna of those early periods.

Above the Red Crag are what are now recognised as glacial sands and clays with scattered boulders of foreign origin. In these latter top-most layers is what might be called a Romano-British "Kitchen-midden," as well as a burial place; numerous fragments of pottery and bones and quantities of the common garden snail. *Helix aspersa*. (*H. Pomatia* the apple snail is not known there,) are abundant. The Professor and myself unearthed on one occasion, a skeleton, by the side of which was an elegant, vase of red clay. The skull and vase are now in the Ipswich Museum.

In consequence of the encroachment of the sea at this point of the eastern coast, landslips frequently occurred, thus causing a succession of semicircular "bays" in the cliff, the fallen masses shelving from within a few feet of the beach to as many from the summit of the cliff, some seventy or more above it. The width and depth of these semicircular bays being about 100 feet (1).

The surface of this sloping portion was strewn over with the debris of the Red Crag, including vast quantities of "nodules." (2) It was these latter which first drew Professor Henslow's attention when geologizing, accompanied by the writer, then first initiated in the delights of the science of Geology. Taking a few home that struck him as being peculiar in form, he examined them carefully; finding that not infrequently some fossil organic body, such as a shark's

tooth or a shell was embedded in the nodules, he strongly suspected them to be phosphatic in their nature, more especially as his first impression was that the majority, if not all, were genuine "coprolites". (1)

This view he communicated to the Geological Society, and he also published a few remarks in the "Gardener's Chronicle" (1841, p. 43). He however, subsequently considerably modified this idea, being by more extended observation convinced that they were either nodular concretions, or mere hardened masses of London Clay, which had been rolled into various shapes at or more probably preceding the time the clay was deposited, which had subsequently undergone some alteration in their mineral character, having become highly "charged" with phosphate of lime. Some of these nodules were transmitted to Mr. W. H. Potter, Fore Street Lambeth, who proves, as the Professor had suspected, that they contained a large proportion of phosphate of lime, in fact about 56 p. c. He at once saw that now was the time for Liebig's anticipations to be realized and there was a vast source of profitable material opened for any enterprising agriculturist. Deeming it inconsistent with his clerical profession to engage in any pecuniary speculation, he did not hesitate a moment in leading others to profit, by his discovery. He communicated it to a general manufacturer, Mr. now Sir John Bennett Lawes, who desired a ton of nodules to be forwarded for experiment. The Professor procured the assistance of a number of the Villagers of Felixstow to collect the nodules. They were sent direct to Mr. Lawes. Although the idea of manufacturing the superphosphate could not at first be entertained, in consequence of an exaggerated notion of their value being afloat: so that a higher price was often demanded for the raw material than for the manufactured article, yet, as soon as a more reasonable value was assigned to the nodules, they became a staple commodity of trade.

Thus was the dream of Liebig's fond imagination realised; a dream, indeed as many including the Professor himself considered it to

(1) At the present day, this feature is not so conspicuous as it was forty years ago.

(2) If I remember rightly, shells and, teeth, and nodules from the Red Crag are to be seen in a case in the Public Library Valletta.

(1) It was due to this mistake that the word "Coprolite" became the commercial term for these phosphatic nodules.

be; for thus he spoke of it: "Devotedly as we may all desire such a consummation, let us neither too hastily adopt, nor too hastily reject, these speculations of the German chemist. If he is correct in supposing that the phosphate of lime contained in fossil bones and coprolites, can be economically converted to the same purposes as that in recent bones his observations will be worthy of the most serious attention of agriculturalists."

This has long ago proved to be case. Forty years have elapsed since those words were proved, and a new era opened in the history of agricultural science. Experiment after experiment has been tried and the value of this artificial manure has ever been more and more highly appreciated.

In 1848 a new discovery has made by Prof. J. S. Henslow. "It had long been a remark of common notoriety, that the soil of the lower part of the chalk formation possesses remarkable powers of fertility, very little or no manure being required to produce the crops; especially in the application of bone manures; and in most instances it was positively useless" (1). This occurs upon the "out-crop" of the upper Green Sand deposit, which is immediately below the chalk at Farnham in Surrey.

M. T. Mainwaring Paine, in December 1847, forwarded some "Marl" to an eminent chemist, and the result of his examination proved that a large percentage of phosphate of lime was contained in the soil; nor was this all: in trenching for drains through the Gault, the Lower Green-sand was exposed upon which the former reposes. This, too proved to contain layers of a "Mortar-like" substance, with nodular masses interspersed, highly charged with earthy phosphates.

On the publication of Mr. Paine's interesting discovery, Prof. Henslow called attention, in the 'Gardener's Chronicle' to the Suffolk nodules, which were then being raised at the rate of sixty tons per week; as well as to the fact that he had previously suggested to Mr. John Deck, a practical chemist of Cambridge, to analyze some of the nodules so abundant in the Upper Greensand stratum in the neighbourhood of that town.

(1) *From the "Agricultural Gazette", 1848. p. 121.*

Having followed the Professor's suggestion they proved to contain earthy phosphates in proportions varying from 57 to 61 p. c. The Prof. had communicated his views in a letter to the "Bury Post" July 3rd, 1845, nearly three years previous to Mr. Paine's re-discovery, concluding with the words—"Whether these various nodules, thus abounding in phosphate of lime, can be made available for agricultural purposes, must depend upon the possibility of their being collected at a cheaper rate than an equal quantity of bones can be. Perhaps this is a point not yet sufficiently determined though my own opinion is decidedly in favour their being sufficiently abundant to collect them." This was soon to be realized; but a few years elapsed, when every tenant who owned a crop of Upper Green-sand in the neighbourhood of Cambridge riddled his acres with pits. If one walked from Bambridge along any pit roads into the country, within distances varying from the suburbs to two or three miles, the eye could not fail to see one, two, three or more pits in the adjacent fields. The process of acquiring the nodules there is considerably more laborious than in Suffolk. Pits are dug, and the "Marl" or clay is thrown into circular trenches, in which a rake is drawn round and round by a horse, while water is continually being pumped into it. By this means the clay is washed away, and fossil shells and nodules are left behind (1). At Felixstow all that is requisite is to sift the sand from the nodules and fossils which are there thrown together into a heap to be conveyed at once to the manufactory.

As other localities which have subsequently been discovered, Potter in Bedfordshire may be mentioned; where are quantities of rolled pebbles, ammonites etc apparently like those of Felixstow being the remains of a beach—but belonging to the Lower Greensand, if I remember rightly, another occurs near Flamborough Head Yorkshire, called the Black-rock. This is in the Gault or

(1) *As is the case of the Red Cray so with the upper Green-sand the fauna of the period is now much known in consequence of this discovery of the use of the nodules; bones of a pterodactyl, for instance which must have been 24 feet in length of wings have been found.*

perhaps on the horizon of the Kimmeridge Clay; but I do not know whether Geologists have accurately fixed it or not. When residing at Steyning in Sussex, of which place I was the curate in 1859 I found a pit from which sand had been excavated in the Lower Green-sand containing the mortar-like band, (1)' with a few characteristic fossils, and an abundance of balls of indurated clay, about one and a half feet beneath the surface. Suspecting them to contain phosphate of lime, as they much resembled specimens from Farnham, in my collection, I transmitted them to Messrs Borton Bros., Chemists of Brighton, who kindly undertook to analyze them. The result proved that they contained over 80 p. c. of phosphate of lime—higher, in fact, than any I had ever heard of.

Such is a brief account of the original discovery of phosphate nodules, which in less than twenty years opened out a new epoch in the history of agricultural manures. Practical men have reaped golden harvests from the discovery, though very few of the thousands who have benefited by it, know that it was the late Professor. J. S. Henslow—ever ready to impart his scientific knowledge and discoveries for the benefit of others—who first called public attention to the commercial value of Phosphate nodules. He rests from his labours, but the results of his active disinterested mind will be of lasting benefit to his country.

He died at Hitcham Rectory, Suffolk where he was the Incumbent.

On the extraordinary abundance of *Deiopeia pulchella* Beis in Malta.

It is worthy of notice that that this pretty moth has occurred in unusual abundance this year, and at the moment of writing (10th August) and for a fortnight past it has been the commonest moth to be seen on the wing. I do not remember in fact ever having had occasion to record such

(1) This band has been recognised by geologists and described as a "phosphate paste" intermediate between the Gault and Lower Green-sand. It is about 1½ feet in thickness, and remarkable for its uniform continuity. It was doubtless the same band which Mr. Patne discovered re-appearing on the south side of the North Downs at Farnham Steyning being situated on the north side of the South Downs.

extraordinary numbers of any butterfly or moth. In the open country and in fields, especially where the *Heliotropium europaeum*, on which the *Deiopeia* feeds grows, it is a most curious sight to see the innumerable quantities of this pretty species, fluttering here and there looking like large animated snowflakes. Nor is it only by daylight that the moth appears, but also in the night it is found in great numbers attracted by the lights. Mr. R. Briffa, a friend of mine and a gentleman greatly interested in our lepidoptera was telling me that at Sliema there where thousands of the species flitting about in every part of the gardens and fields. The same may be said of all other parts of the island as I have seen The Marsa, Corradino, Notabile, Attard and many other places teeming with this moth and its catterpillar.

As to the cause of such an unusual frequency I believe it is to be referred to the rains which fell during the late spring causing an overgrowth of the *Heliotropium*. The extra abundance of this plant from which the moth derives its sustenance may therefore in a measure account for the unusual numbers of this insect.

For those of our readers who have not had an opportunity of examining it, I may add that the moth is white with small red and black spots on the forewings and with white underwings bordered with black. It is subject to much variation sometimes the black dottings predominating, sometimes the red ones, but it is a very characteristic form and very easily distinguished.

ALFRED CARUANA GATTO.

The Eruption of Etna.

During the last month the eruption of Etna underwent many varying phases of activity, at one time abating to such an extent as to suggest exhaustion, and then breaking again out with great violence.

From the 1st to the 5th of August it subsided, but on the 6th ult. activity was renewed with redoubled violence and kept up until the 15th ult, after which it waned again. On the 6th a succession of earthquakes, that were felt in Syracuse, and that equalled in intensity those that ushered in the outbreak on the 12th of July, were expe-

rienced and shortly afterwards Monte Gemellaro recommenced action. The great lava stream which has been flowing from this cone during the last three weeks increased in volume and on the 7th inst. it divided into two great branch streams, both of which flowed in the direction of Serra Pizuta covering *en route* the lavas of 1886.

The mountain is still in labour, but the lava is now issuing so slowly that instead of making progress, it is cooling and heaping itself on the streams that have been formed during the past few weeks.

The damage that has been wrought in the vine growing districts on the southern slopes is enormous, and much anxiety is being felt for the welfare of the "contadini" during the forthcoming winter. Nicolosi and Belpasso are now out of danger, and the inhabitants are becoming more tranquil, though great distress prevails in both districts. The general appearance of Etna has not been greatly affected by the present prolonged outbreak. Several of the smaller cones as Gemellaro and Montanaro have been surrounded by new lava sheets, and several new excrudescences have been formed, but otherwise from Catania, or Crifeo, no change is noticeable.

Alluding to the eruptive powers of this volcano a writer in the "Morning Post" observes that Etna may lay claim to a long established reputation for its volcanic tendencies, as historic memory does not extend to a time when the fires of Etna did not exist. Of this there can be no doubt as the mountain was in a state of activity before the Trojan War, and three eruptions are recorded in the period covering the eighth and fourth centuries before the Christian era. Five more eruptions are stated to have taken place in the next three hundred years, a very violent one occurring in the year 44 B.C. Since that time eruptions innumerable have been recorded. To the geologist, indeed, the story of Etna is written in its formation. It rests on a floor of stratified marine volcanic matter with clays, sand, and limestones of Newer Pliocene age.

It will have been observed that the recent eruption of Etna has been synchronous with a display of activity in Vesuvius, and with a violent volcanic disturbance in Sangir. Can we trace all to the same cause? Last year Professor Alfred Kirch-

hof, of the University of Halle, propounded a theory that excesses of volcanic action and the uncertain weather of last summer were alike due to oscillations of the earth's axis. This is not the place to discuss so abstruse a question, but assuming Professor Kirchhof's theory to have any foundation, it may possibly explain the exceptional volcanic activity of the last two months.—

J. H. C.

A marketable commodity.

Some curious instances of the restrictions that are placed upon the use of sea water in some parts of the Mediterranean, are given in the *Scientific American*, among which the writer tells us that some years ago while on a visit to the shores of the Mediterranean a member of his family was ordered by the doctor to take a salt water daily, at his hotel. But before the attendant dare to dip even a pail of water from the sea a permit from the prefect of the police had to be obtained, and to get his permission it required the physician's certificate.

Another equally ludicrous incident is related by a writer to the *New York Tribune* in the course of which he tells us that a well known English public man, member of a former administration, staying in one of the many quiet and pretty villages on the Riviera, the garden of his temporary home running down to the sea, on a recent morning, wished to vary his usual bedroom bath by substituting salt water for fresh, he asked that a pailful be fetched for him. To his intense amazement he was informed that this could not be done without special permission from the civil power. There was the Mediterranean stretching broadly before his bedroom window, countless miles from east to west, and away again toward Corsica in the south as far as the eye could reach, and at the end of the garden, mind you, and yet as much of it as would fill an ordinary pail must not be taken from it. It was too absurd for belief. It turned out to be quite true, however. Not a servant nor a villager could be induced to draw a few quarts out of the sea for fear of the penalties which would follow, and in the end the official

permission of the mayor of the village had to be formally sought and granted before the English politician could have a salt water sitz bath. The tax on salt was at the root of this anomaly, and the stringent restriction was to prevent the natives from boiling down sea water and making salt for themselves.

The Peronospora among the Malta vines.

The past year or two has witnessed considerable activity in the development of the vine-growing capabilities of these islands, the geognostic and climatic characters of which are such are eminently adopted to vine culture. Among the many causes that have contributed to the introduction of this change, one of the most important is the great decadence that has lately taken place in the orange growing industry and the desire that has been manifested to see it supplemented or replaced by one which might not only be a direct source of revenue to the country, but which would also be the means of employing profitably the energies of the large agricultural population which is solely dependent upon the soil and its produce for their sustenance. Much distress has been occasioned among the agriculturists of the islands by the ravages among the fruit and vegetables of a number of parasitical foes both animal and vegetable, which have wrought such havoc as to seriously threaten the very existence of many branches of agricultural industry. During the last year or two the damage thus caused has assumed very serious proportions and the Government has therefore, with a view of mitigating the evil, appointed various commissions to inquire into the causes of, and to suggest remedies for it. Many of the diseases have, however, taken so deep a root that whether they now be eradicated or not, considerable losses must be incurred by both capital and labour.

It was at this juncture that several gentlemen of the island came forward and with commendable enterprise and patriotism endeavoured to supply the places of some of the old industries by the introduction on a large scale of vine culture a branch which is carried on with great success and profit in the neighbouring islands and countries.

They expended large sums of money and caused extensive tracts of country both in Malta and Gozo to be laid out and planted with several hundreds of thousands of vines. The interests at stake were large, and the anticipations of what Malta might become as a wine-producing country were hopeful, and it was therefore with no small feelings of regret that the Government and the public were informed a few weeks ago that the vines in both islands had been attacked by the *Peronospora*, one of the most virulent, and destructive of the diseases to which the vine is subject. The "mildew" as it is popularly called, has been in existence in France and in Northern Italy for the last fifteen years, but it was not until this year that it made itself manifest either here or in Sicily.

As soon as its presence had manifested itself the Government authorities took immediate steps, and appointed a commission to enquire into the extent and character of the new invasion. The result of these enquiries has been to show that the disease is diffused to a greater or lesser extent throughout both islands, but that it seems to be in a more advanced state of development in Gozo than it is in Malta. Of the many hundreds of plants that were examined in the vineyards of Kala, Uied San Blas, Sannat, and other localities all, without exception were found to be badly affected.

In the majority of cases the disease was confined to the leaves only, but a large percentage had their branches attacked and the fruit was found to be in a very dwarfed and undeveloped state, a fact that was undoubtedly due to the devitalizing effect of the fungus which was preying upon them. In the inhabited districts where the vines were not numerous, and those that did exist were well sheltered from the Sirocco by high walls and dwelling houses it was observed that they were either quite free from the disease or where it had made its appearance, it occurred in such a modified form as to be practically harmless.

The nature and the principal characteristics of the disease may not be without some interest to our readers.

The *Peronospora* is a parasitical fungus belonging to one of the genera of the order MUCEDINES, which is a subdivision of a family of plants known by the name of *Hyphomycetes* signifying "thread"

and "fungus" and hence so called on account of the thread-like filaments which form one of its most prominent characteristics. It infests all orders of plant life, attacking in particular the potato, onion, lettuce, pea, wheat, and the vine.

The species which attacks the vine is the *Pero-nospora viticola*. It develops itself on the twigs, fruit, and leaves alike, but it is usually on the last of these that it first manifests itself.

It makes its appearance as a whitish efflorescence which develops on the underside of the leaf accumulating in the greatest quantity on and around the veins, while on the upper side it assumes the appearance of yellowish and reddish-brown spots, that impart to the leaf a faded and mottled aspect. A leaf thus affected gives forth a characteristic fetid odour when rubbed between the fingers.

The fruit is attacked by a similar efflorescence which destroys the bloom, and accumulates in such quantities around the peduncle, as to absorb all of the fluids of the grape, thus retarding their growth and causing them to rot away and fall off.

When examined under a microscope of a moderate power the fungus will be seen to consist of a network of ramifying threads, which cross and recross one another, entering into and entwining themselves among the intercellular spaces of the leaves, and giving forth a perfect forest of prehensile threads which stand forth at right angles from the surface, and which bear at their extremities enormous numbers of minute ovoid and rounded bodies called spores.

This vegetative system of ramifying threads, with its concomitant spore-bearing filaments is known as the *mycelium*, and it is within it that the spores, by means of which the disease is propagated, are generated.

Within the tissues are certain cellular bodies known as the *oogonia* and the *antheridæ* containing a granular protoplasm or formative fluid and having a presumed sexuality. The *oogonia* are the female organs, and the *antheridæ* are the male and by them are produced the *oospores*, which are afterwards developed in the *mycelium*. The *oospore* consists of a membranous sac containing a thin fluid matter. It is of a rounded form, and as it is developed in the greatest numbers in the autumn, it is commonly known as the autumn

spore. They are to be seen on the threads of the *mycelium*, and as they have great resisting powers to heat, cold, and wet they often remain dormant and unhurt for many months after the death of the plant to which they owe their existence.

Humid conditions and a high temperature are highly favourable to their development, and it therefore follows that they are most active during the Spring and Autumn and that during the Summer and Winter they are practically quiescent. Rain, dew, fog, and hail, greatly assist also, but the most potent factor in this climate is the humid unwholesome Sirocco. Badly drained lands, clayey soils, and the proximity of springs also play an extensive part in fostering the fungus.

With the return of Spring the oospores become once again active and under the combined influence of heat and damp they generate the *conidia* or summer spores. These *conidia* are oval bodies, which are developed in the *mycelium* and are given off from the extremities of the branchlets. They are so exceedingly small that it would take one hundred million of them to cover a superficies of one square inch.

They are generated very rapidly, and being easily detached they are wafted to great distances by the wind, and, as every spore is capable of forming a separate vegetative system or fungus, the rapid manner in which the disease has spread in these islands will be at once understood. The Sirocco plays a double part in the propagation of the spores. Its warmth and damp favour the generation of the *conidia*, while its movements disseminate them over the islands.

It is to its influence, combined with the exceptionally wet conditions that prevailed during the months of May and June, when 3.22 inches of rain are recorded as having fallen, and the abnormal rainfall of July when 3 inches fell, that we may largely attribute the present deplorable state of our vines.

The action of this fungus on the vine is most demoralizing. It paralyzes the respiratory functions of the plant, and by absorbing its nutritive juices, it devitalizes it.

From this brief notice of the causes, effects, nature, and conditions most favourable to the propagation of the disease I shall now pass on and briefly consider the methods of treatment that have

been suggested by the Commission, which if faithfully followed, and methodically carried out will assuredly rid the islands in a comparatively short period of time of this most pernicious plant. Unlike many of the diseases to which Malta plant life is subject, that caused by the *Peronospora viticola* is amenable to a method of treatment which is at once cheap, easily applied, and effective. The disease has been in existence in France and Northern Italy for many years, and as the governments of those countries have expended vast sums of money on experimental research having for its object the most efficacious means for combatting this disease, we have the additional advantage of having their experiments and experience to guide us. The result of their work has been to prove that there is but one effective remedy at present known, and that is sulphate of copper; and that although sulphate of copper is a strong poison no apprehension need be felt in using it, for if used in the proportions recommended it is quite harmless. Lime, sulphur, charcoal and a variety of other materials have been tried, but as a specific against the disease they are all worthless.

Sulphur has been used on the vines in these islands for many years as a cure for the *Oidium* (black rot) and the *erinea*, for both of which diseases it is a good remedy, but for *Peronospora* it is absolutely useless and the sooner the Maltese vinegrower recognises this fact the better it will be for his pocket.

The sulphate of copper is a very cheap chemical. It may be applied either in a dry state or in a liquid form. To apply in a dry state a powder consisting of 3 parts of sulphate of copper and 97 parts of sulphur (or charcoal) should be thoroughly mixed together and afterwards scattered over the foliage of the plants by means of pair of bellows, or with a tin-can having a perforated head. Either sulphur or charcoal may be used, as it is only of service as a carrier for the sulphate of copper. The prohibitive prices of sulphur in Malta will perhaps suggest the use of the alternative, charcoal, which, besides performing the functions of a carrier will also improve the soil, and free the plants from insects.

The liquid form is however the one to be the most strongly recommended. The following very simple mode of mixture has been proposed in the

report of the commissioners.

1. A half an ounce of sulphate of copper (blue vitrol) to be dissolved in a pint bottle of water.

2. A half an ounce of slacked lime to be thoroughly shaken up in a bottle containing an equal quantity of water.

3. Mix the two thoroughly together so as to form a perfectly homogeneous liquid, and then add to it sufficient water to make up to one eighth of a barrel known in the vernacular as one quarta.

This mixture should then be sprayed on the plants by means of common garden syringes, or with the combination pump and syringe which has been specially constructed for the purpose.

Among the poorer agriculturists of Sicily, to whom the expense of purchasing such instruments as these is an unsurmountable obstacle in the way of their adopting this mode of treatment, I saw a novel but most simple substitute, which, though it necessitated the expenditure of a much longer time in the application of the mixture, was, I was assured equally as efficacious. The *modus operandi* was as follows. The mixture was carried among the vines in wooden buckets. Into it the operative dipped a large brush, such as that which is commonly used for white washing, and by means of an upward, followed by a sharp downward movement of the arm the contents of the brush were sprinkled over every portion of the foliage. It is a method that should recommend itself to all those who are unable to obtain the syringes, as it is both effective and cheap.

The effect, which the sulphate of copper has upon the fungus, is to paralyze the generative functions of the *oogonia*, and to thus effectually stop the propagation of the *oospores* and *conidia*.

Considering the widespread diffusion of the disease, not in these islands only, but also in all of the countries along the Mediterranean shores, the commission recommends that *immediate steps* should be taken in order that the generation of the *oospores* which are now in course of formation may be arrested, and the grape harvest of next year saved. The treatment above recommended should be at once applied after which, a regular and methodical course as follows should be adopted.

- I. As soon as the buds of the vine appear, the plants should be treated with the powder consist-

ing of 3 parts of sulphate of copper, and 97 parts of sulphur (or charcoal).

II. When the plants are covered with foliage, the liquid treatment, as recommended, should be applied.

III. When the grapes begin to mature the powder containing 5 parts of sulphate of copper and 95 parts of sulphur (or charcoal) to be used.

IV. After the grapes are collected the liquid treatment should be again applied with a slight excess of sulphate of copper.

The present deplorable condition of the vines in Sicily, Italy, and Greece, where the wine and raisin industries have this year been all but paralysed offers itself as a good object lesson to the agriculturists of these islands. Here, the disease is now but in its incipient stages, and if therefore energetically wrestled with there is every probability that it will be possible to keep it in subjection so as to render its effect practically harmless; but if it be allowed, to firmly established itself, there can be no doubt whatever that the projects for the cultivation of the grape on a large scale and the establishment of a wine industry in the Maltese islands will have to be relegated for another decade at least to that limbo of Utopian ideas in which so many well-meant schemes for the islands weal and prosperity have already been stifled.

JOHN H. COOKE.

(*Member of the Commission.*)

The Meadow of Nysa in Asia Minor.

BY

CAPT. MOORE, R.N.

The Meadow lies at the foot of the highest crest in this part of the Messogis range, called Bey Dagh, which is the watershed whence the streams flow north and south into the Cayster and Meander valleys. This crest and the heights which bound the plain to the south and west are green downs sprinkled with trees. The meadow is marshy in parts; it is in fact the mother of the springs which feed the torrent in the Déré of Malagatch, and which clothe the orchards and vineyards round Sultan Hissar with so rich a verdure. We had no instrument at hand to determine the precise height above the Meander valley, but we estimated

it to be not far short of 5000 feet. That the elevation was great was evident from the fact that although the barley harvest had already begun in the valley, the few fruit-trees around us were still white with blossom, and no other trees had yet begun to show their leaves.

There can be little doubt that the Ovajik is the Peimon mentioned by Strabo. It is a remarkable spot, the only level piece of ground for many miles from Nysa in a northerly direction, and the road to it through the ravine is so marked out by the nature of the ground that the traveller cannot deviate to the right or the left, and is led on his way northwards to this spot. It is true that the valley of the Meander was close to Nysa on the south, but, as has been shown, the Meadow must have been to the north of that city, and there may have been reasons why this secluded plateau among the mountains was preferred by the Nysæans to the more convenient plain at their feet for the celebration of their festivals. It was far less exposed; the approaches to it could be more easily guarded, and religious associations appear to have been connected with the locality. The only difficulty in accepting this view appears at first sight to lie in the distance from Nysa, which Strabo gives as 30 stadia, or $\frac{3}{4}$ miles: whereas the Ovajik must be between four and five times that distance. But as any site, within four miles from the city, must obviously have been on the southern or Meander slope of the range, it is impossible to place the Meadow, described in connection with the Cayster valley and the Tmolus, on the southern side of the Messogis. The apparent discrepancy may be explained if we suppose that Strabo wrote "130 stadia" and that the 100 has been omitted by some transcriber of his M. S., either by inadvertence, or, it may be, intentionally—the distance of 190 stadia from the city appearing to the transcriber much too remote for the site selected by the Nysæans for the celebration of their public games and festivals. It would be a very difficult task to measure with precision the distance traversed over such ground as lies between the ancient city and the Meadow: it may be rudely calculated, however, by the time it takes to reach the latter. Mr. Purser, who has had much professional experience in Italia as well as in Asia Minor, calculated from the time

it took us to traverse the ground that it was about 17 1/2 miles or 140 stadia from Sultan Hissar to the Meadow, which, when the distance between the station and the ancient city is deducted, will leave a total closely accordant with the supposition that the distance stated by Strabo was 130 stadia.

We had no time when on the Meadow to search for the cave or opening in the ground, which Strabo tells us was a subterranean passage leading westwards towards Acharaca, and we met no one of whom to enquire, save a band of eighteen zaptiehs, who had come up from the Cayster valley in quest of brigands, the deserted hut on the meadow being known as a favourite haunt of those gentry. Strabo speaks of this meadow as, according to popular belief in his day, the "Asian meadow" sung by Homer, and says "they point out the *heroum* of Caystrius and of (a certain) Asias, and the Cayster flowing around it.

"Of storks or cranes or long necked swans Asian meadow about the streams of Cayster. Hither and thither they fly rejoicing in their wings." *Iliad*. II, 461.

But this tradition is difficult of acceptance, for the Meadow is too high in the mountains to have attracted waterfowl, and too remote also from the Cayster. It is far more probable that Homer referred to the plain of the Cayster, or to some portion of it, particularly to the low part near Jelat and Ephesus, which in winter is a vast marsh, where cranes, wild swans, and geese may be seen in multitudes at the present day, just as described by Homer, and by Virgil (*Georg.* I, 383, *Æn.* VII, 699) in his imitations of his illustrious predecessor. It must be understood that the Asian meadow received its name from the hero Asias, who with Caystrius had a *heroum* there, and was an early king of Lydia, the son of Cotys, son of Manes, from whom a tribe in Sardis was called Asian (*Herod* IV, 45). Strabo spent some time in his youth at Nysa, as he tells us, studying philosophy under Aristodemus; we may presume therefore that he visited the Meadow, whither the Nyseans resorted to celebrate their festivals, and that he wrote from personal knowledge of the spot. But he does not state that the *heroum* or shrine, stood on this meadow, or even near it, but simply that it stood on the banks of the Cayster, and we may infer that it was visible from the Meadow of Nysa.

Assimineæ littorina Delle Chiaie in Malta.

When collecting *Auriculæ* in the brackish-water fish-ponds at Marsa Scirocco in February 1890, I was agreeably surprised to find a tiny shell in considerable numbers under stones washed by the water, or under the rotting leaves of the *Caulinia oceanica* strewn on the beach. I could not at first find out to what species it belonged I therefore sent it for determination to Prof. Boettger of Frankfort, who with his usual kindness quickly answered informing me that it was *Assimineæ littorina Delle Chiaie* remarking to me that it was not to be expected this species should have been found in Malta but rather *A. Sicana Brugn.* On further collecting in the same locality I began to doubt if all the *Assimineæ* from Marsa Scirocco really belonged to one species and my doubts were shared by my friend the Marquis of Monterosato of Palermo, who in February 1891 wrote me that he thought the typical *A. littorina* was wider than the Maltese species, whilst *A. sicana* was altogether bigger. He considered our form to be very similar to *A. Shotellerii Bourg.* Not knowing this species I sent a few specimens to Prof. von Martens, to have them compared with the type in the Berlin Museum. In answer to my queries he told me that our species agreed in all respects with Philippe's type which is in the Berlin Museum and that he did not think it necessary to separated it as a variety. *Assimineæ* are generally considered as marine species; in our case they are to be found with the *Auriculæ* and *Teunaticellæ* close to the rocks and stones of the shore above high water level and with *Setiæ* on the *Confervæ* floating on the surface of the water of the ponds. It must be added that these ponds are on the shore and connected with the sea, but they receive also the fresh water which drains from the surrounding country.

ALFRED CARUANA GATTO.

The Relationship of the Structure of Rocks to the conditions of their Formation.

By H. J. JOHNSTON LAVIS, M.D., F.G.S.,

These facts, I think, give us the clue to the real sequence of phenomena which lead up to, and

result in, the different varieties of eruption. Let us suppose that an extensive igneous dyke has, from some circumstances which will be discussed later on, become plugged at the exit on the earth's surface. The part of the magma that retains a sufficiently high temperature will be gradually absorbing water; and as assimilation proceeds the extension of the magma will proportionally increase, and the temperature of the mixture reduced, so that in some cases this loss will gradually favour solidification of portion of the magma forming the crystals of the felspars, Amphibole, Biotite, and other micas, &c. Such a state of things will go on until one of two things takes place—either the loss of heat be such that the whole igneous mass solidifies, or, on the other hand, the tension overcomes the resistance, and an eruption take place.

Other things being equal, we should expect the violence of the outburst to be directly proportional to the length of contact of the igneous magma with water-bearing strata, or in other words, the longer the quiescence the greater the violence in the subsequent eruption.

The diffusion or solution of water through the igneous magma will diminish in a progressive manner as saturation increases. The amount that may be taken up is demonstrated by the enormous volumes that escape during an eruption. Were it possible to calculate the amount of vapour expelled during any great eruption, and to estimate the solid ejectamenta—also a difficult matter—these added together would give us the composition of the paste immediately before its expulsion, unless we have the level of the magma surface below that of the drainage-line of the country, in which case the vapour would be increased by the inpour from the porous walls of the chimney, and a pulverization of such water similar to the action of a spray apparatus, when the amount of vapour expelled might be enormously augmented. Such calculations have rarely been attempted. Cavalleri (1) estimated that from Vesuvius, in 1856, during a period of eighteen months, pending which the strombolian state of activity had per-

sisted, that no less than 407 millions of cubic meters of water had been ejected in the form of vapour. We may form an idea of the mass by imagining a lake $6\frac{1}{2}$ kilometers square, and 10 meters deep. I cannot form a just conception of the amount of vapour issuing from Vesuvius on the above occasion, but from a long and intimate acquaintance with this volcano during the last six years, it seems to me that the above calculation is greatly in excess of the truth, such a result being quite comprehensible when we take into consideration the almost insurmountable difficulties of finding suitable data to go upon. If we form a conception of 516,500 kilogrammes of water escaping every minute in the form of vapour from an aperture of four or five meters in diameter at the most, it certainly seems the feeble state of strombolian action would be out of the question.

It was also calculated (1) that 22,000 c. metres of water were daily dispersed in the form of vapour by the lateral openings of Etna in the eruption of 1865, that is, equal to 2,000,000 c. metres, for 109 days that that eruption lasted. This estimation, which, I believe, is that of Fouqué, certainly appears more reasonable than the former.

One is apt, however, to attach a greater value as regards quantity to volcanic vapour, from the peculiar molecular state which it assumes immediately on its escape, which is probably due to conversion of the steam into vapour, by the process investigated by Dr. Aiken. Everyone is aware that our breath in the hottest weather is converted into a white cloud when near the vapour of HCl. Nevertheless, whatever value we may put upon the above calculation, we cannot do otherwise than comprehend the very large amount of water that may disengage itself from the igneous magma.

In the case of a fissure whose upper limits are very far beneath the surface, and suddenly extends thereto, we should expect the eruption to be less violent than were the magma in closer proximity; since a large part of the energy of tension would be lost in the expansion in injecting the extension of the fissure.

(1) *Considerazioni sul vapore e conseguente calore, &c. Memoir read in the Accad. Fizio-medico-statistica di Milano, December 27th, 1856.*

(1) Quoted by M. Ch. Vélain. *Les volcans ce qu'ils sont et ce qu'ils nous apprennent. Paris, 1884, p. 45.*

Conditions which may determine an Eruption.—

In a large number of cases the gradual increase of tension in the confined magma may go on to the crisis of eruption. But in certain cases the intervention of collateral influences may anticipate such an occurrence. An increase of upward pressure from the main volcanic source, dependent upon secular cooling, tidal action (if such exists), or other causes, may be sufficient addition to the amount of tension already existing to more than balance the resistance. A sudden lowering of atmospheric pressure may be sufficient in some cases to render the superincumbent pressure less than the tension of the igneous magma. It is known that, as the rainfall is increased in the season, the drainage level of a country reaches a higher line, and therefore the superincumbent pressure increases; and, *vice versa*, the superincumbent pressure diminishes during a drought, so that a sudden relief of pressure may be the metaphorical *last straw*.

The greater the height in a temporarily extinguished volcano the greater the weight, or, in an active one, the greater the pressure of the superincumbent column of lava above the drainage level. (1) We might therefore say, that as a permanent volcano increases in height its eruptions will diminish in frequency or increase in power—a fact thoroughly borne out by experience. Under the same conditions, in a lateral opening of a very high volcano, such as Etna, the amount of lava will be greater as the chimney is higher above the outlet, since it will hold more. But beyond this, the amount of output will be more than that contained in the chimney above the level of exit, but also indirectly as the pressure of that amount is removed. When the lava pours out laterally from the chimney, its superincumbent weight, being removed, will allow expansion of the elastic matter below the level of exit, so that as this rises to establish a balance, lava will continue to pour out from the lateral outlet until total equilibrium is obtained. In this way the amount of lava spread

over the surface will be much more than that contained in the chimney above the level of the exit. This fact I have been able to verify on various occasions in the recent small eruptions of Vesuvius, which are in many ways more instructive than great ones on account of permitting near approach to be made. This, I believe, will eventually be proved to be the true mechanism of lateral eruptions. As examples, we may compare the bulk of the lava products from the lateral craterets of Vesuvius and Etna.

Conditions which determine the Extinction of a Volcano.—

We have already seen how a dyke that has not manifested itself at the surface may solidify, and so divert igneous action to other localities. In the case of explosive eruption, the expansion that takes place in the magma increases its volume, in the form of a pumiceous froth, to such an extent that it occupies many times its original volume. (1) A large portion of this spongy magma escapes, leaving the fissure still filled to such depths as to the point where expansion would be prevented, choked, as it were, by this vesicular paste, which may even have solidified by the loss of heat in volatilization, and so may effectually have plugged up the exit. Some such process would really seem to occur in eruptions like those of Krakatoa. We have an illustration of this in opening a bottle of champagne *well up*, in which case more than half the liquid contents may escape in the form of froth. In the expanding magma there would be no distinct line of demarcation between the pumiceous, or frothy portion, and the still continuous fluid mass beneath. If, from the want of supply from below, this does not rapidly rise and issue as a lava, it may go on gradually giving up its dissolved water in that state and by loss of heat may solidify and prevent, at any rate for some time, eruption at that particular volcanic vent. In the types of tranquil activity, either strombolian or in the case of occasional outpours of lava, (2) we have three main agencies at work. In the first place, the aqueous matter contained in the magma will be dispersed, proportionally lowering the temperature. At the same

(1) Let us compare the height of a column of phonolite paste of 100 (?) metres of Monte Nuovo with the column of heavier doleritic paste of Etna of 3300 meters, when we see that this is an important factor in modifying the eruptive character of a volcano.

(1) The volume of steam at 100° C. is 1696 times that of water at the same temperature.

(2) The paroxysmal eruptions of Scrope, Volcanoes, 1828 and 1862.

time, the magma may be absorbing fresh water, raising it to its own temperature, and eventually converting it into vapour, which continues to escape at the expense of its own heat. Last, and probably least important, would be the conduction and convection near the earth's surface by the subterranean circulation of water.

(to be continued)

A year's insect-hunting at Gibraltar.

BY JAMES J. WALKER, R.N., F.E.S.

III.

My most interesting captures were, however, made in the nests of the large black ants (*Atta capitata*, and *barbara*) which abounded under stones. With these ants I was fortunate enough to find the rare and singular little Myrmecophilous Carabid, *Pseudotrechus mutilatus*, Rosh., in company with the equally curious *Oöchrotus unicolor*, Luc., *Merophysia carinulata* Rosh., *Colnocera attæ*, Ktz., and *Dinarda nigrita*, Rosh. The still more wonderful *Paussus Favieri*, Fairm., was found in the nests of a smaller brown ant (*Pheidole pallidula*), but this insect and the *Pseudotrechus* were met with more frequently in February and March.

Early in January I left for England, and returned to Gibraltar on February 15th. The weather was then cool and showery, with warm sunny days at intervals, and I found that vegetation had made much progress during my absence, and a few of the early butterflies began to put in an appearance. Thus, on the 17th, *Papilio Machaon*, *Euchloë Belemia*, E., * and hibernated *Gonepteryx Cleopatra*, L., * were on the wing, reinforced at the end of the month by *Lycaena Icarus*, Rott., * *Astrarche*, Berg., * and *Thais rumina*, L. * The latter beautiful insect abounded both on the Rock and in the Cork Woods, frequenting open bushy spots where its food-plants, *Aristolochia glauca*, Desf., grew in plenty, and it could be caught without much difficulty. *Euchloë Belemia*, on the other hand, usually cost a hard run before it was secured, being (as might be judged from its robust build) as swift and strong on the wing as *Colias Edusa*. *Thestor Ballus*, Hb., * appeared on March 9th, and *Euchloë euphenoides*, Stgr., * on the 11th, but the weather in March, was not favourable for

collecting, and it was not until the 26th that I was able to make my first excursion of the year to the Cork Woods. On this day, which was warm and sunny, the profusion of insect life was very remarkable, and I noticed no fewer than 25 species of butterflies on the wing. *Leucophasia sinapis*, L., was common, *Pieris Daphidice*, L. * (very pale), was not rare, and *Euchloë euphenoides*, flitting quietly from flower to flower, made quite a feature in the scene: with it were a few *E. Belia*, var. *Ausonia*, Hb., and one or two of what I take to be *E. tagis*, Hb., but am not quite sure. *Thecla rubi*, L., although common, was getting worn, and I noticed one or two of an early brood of *Lycaena Telicanus*, Hb., besides nearly all the other species of butterflies as yet mentioned. *Chelonia villica*, L., occurred singly, and worn males of *Saturnia carpini*, S. V., were rushing about in all directions in the Cork Woods. Among the *Coleoptera* were *Cicindela campestris*, var. *maroccana*, F., and *flexuosa*, F., *Melolontha papposa*, Ill., flying by hundreds near the ground in shady places, a fine black *Bolboceras*, and the curious *Sepidium bidentatum*, Sol., previously found by me in abundance at Malaga in 1876. Towards the end of the month I met with the singular little flat yellowish weevil, *Derelomus chamæropis*, F., plentifully in the male flowers of *Chamærops humilis* on the Rock.

The chief entomological feature of April was the abundance of the large *Ateuchi* (*sacer*, L., *variolosus*, F., and more rarely *semipunctatus*, F.), which were to be seen everywhere on the wing, or else, in pairs, busily providing for the future by rolling up and burying balls of stercoraceous matter much larger than themselves. The queer long-legged *Sisyphus Schafferii*, L., appears to be quite rare here, but *Gymnopleuri* of two species and *Oniticellus*, abounded on their food, with the large black *Onitis Olivieri*, Ill. Conspicuous everywhere in the open ground was the huge red-striped *Meloë maialis*, L., and in the Cork Woods, *Endophlæus*, *Cerylon*, *Colydium*, *Plegaderus*, *Platysoma*, *Liodes*, *Hypophlæus* and *Platypus*, were more or less copiously represented under bark. Here, too, I had the good fortune to find the remarkable Brenthid weevil, *Amorphocephalus coronatus*, Germ., in an old cork tree much infested with a large species of ant somewhat resembling *Formica*

rufa: about a week afterwards, near Algeciras, I met with another specimen, all but perfect and in very good condition, in a pellet of a beetle remains thrown up by a nightjar, which had evidently found the weevil a somewhat indigestible morsel. The handsome *Asida holosericea*, Germ., was occasionally to be found running on the paths on the Rock and near San Roque.

On April 19th we had the last heavy rainfall of the season, no less than 6½ inches coming down in 24 hours. A vast quantity of flood refuse was brought down into the Bay by the swollen streams and the wind and tide drove it across to the Dockyard, which, in consequence, teemed with insect life for several days. Among a host of other species I found the fine *Siagona Dejeani*, Ramb., and *Pteropsochus hispanicus*, Dej., for which I had previously searched in vain; also *Siagona europæa*, Dej., *Scybalicus oblongiusculus*, Dej., *Polystichus vittatus*, Brull., *Drypta distincta*, Rossi, *Acinopus megacephalus*, Rossi, *Calosoma indagator*, F., *Anisodactylus heros*, F., and *Scarites levigatus*, F. After this the weather became settled for the summer, and numerous flower-hunting beetles, chiefly species of *Clythra*, *Anthrenus*, *Edemera*, *Meligethes*, *Hoplia* (a bright yellow species, common), and *Dasytes* and other small *Malacodermata*, began to appear. Among the *Lepidoptera* were some very fine large specimens of *Euchloë cardamines*, L., in the Cork Woods on April 8th, where *Pyrquus Sao*, Hb., appeared on the 16th, but the first brood of this species was scarce and local; on the 22nd the pretty *Epinephile Pasiphaë*, E.,* was first observed, and was numerous a week latter on grassy, bushy slopes. The var. *Glauce*, Hb.,* of *Euchloë Belemia* was on the wing by the 23rd, and *Melitæa Phœbe*, Kn., and *Lycæna melanops* Bdv., were found in abundance and superb condition on the 30th, in a heathy part of the Cork Woods. On the same day I took *Lycæna bellargus*, Rott. (2), *Cerochla scapulosa*, Bdv., and the pretty pink Geometer, *Pellonia vibicaria*, Clerck.

May produced more than a dozen additional butterflies to my local list, viz.: *Epinephile Janira* var. *Hispulla*, Hb. * (7th), and *E. Ida*, E. * (12th), *Pamphilæ Thaumæ*, Hufn., and *Acteon*, E. (12th), *Pyrquus Proto*, E. * (14th) *Thecla spini*, Schiff. * (14th), and *T. ilicis*, E. (21st). These were all

more or less abundant except *T. spini*, which was confined to a small space in the Cork Woods, where, on the 21st, I obtained a beautiful specimen of *Melanargia Thetis*, Hb. (*Ines* Hfsgg.), the only one which I saw. A week later (28th), *Gonepteryx Cleopatra* was on the wing in the most lovely condition, and I saw a magnificent *Argynnis Pandora*, Schiff., in the Cork Woods, which however, I could not capture. A visit to Algeciras on the 16th produced *Spilothyrus althææ*, Hb., and the beautiful blue variety *Lorquiniæ*, H.S., of *Lycæna minima*, Fuess. *Canonympha Pamphilus*, L.,* was also taken on the Rock during May, but appears to be rare here, as I heard of but two specimens. The beautiful *Zygæna lavandulæ*, Es., was seen in plenty near San Roque on the 7th, but could not be found a week later; at the end of the month, *Z. bœtica*, R., occurred abundantly on a species of *Cytisus*, both in the larval and perfect states, and a second smaller brood occurred in September. *Deliopea pulchella*, L., always common, was so numerous in the middle of the month as to be a nuisance, and the larvæ of *Saturnia carpini* and *Ophiodes lunaris*, W. V., were to be seen all over the Cork Woods. The beautiful larva of *Spintherops spectrum*, F., abounded on the white broom, *Retama monosperma* near Linea. Among the *Coleoptera*, two fine species of *Cetonia* and four of *Larinus* frequented the flowers of the wild artichoke (*Cynara cardunculus*), in company with two species of *Agapanthia*, and a fine beetle related to *Clerus*. *Trichodes sipylus*, L. (abundant) and *octopunctatus*, F. (rare), with sundry species of *Acanthoderæ*, *Clytus*, *Mordella*, and *Cryptoccephalus*, were found on umbles, while *Omophlus ruficollis*, F., *Cardiophorus serripunctatus*, Latr., and *Hymenophila strigosa*, Ill., were to be seen on almost every flower. A large and handsome *Julodis (filelisma)*, Mars., I think) was occasionally taken on the wing, but on the whole, the *Buprestidæ*, and especially the *Longicornes*, were very much scarcer than I had expected to find them.

(to be continued.)

NOTES AND NEWS.

The Royal Geographical Society have resolved to throw open the Fellowship of the Society on the same terms and conditions to both sexes.

An English naturalist asserts that worms with two tails are by no means rare, but that one of the most peculiar abnormalities he has ever seen is the double head of a long worm (*Allobophora longa*) from Perth. When in motion, the second head has all the appearance of a snail's feeler, or antenna.

"*Natural Science*" contains among other articles the following "The Permanence of the Great Oceanic Basins" by Dr. A. Russel Wallace, "The Climate of Europe during the Glacial Epoch" by C. Reid, F.G.S. "Death" by P. Chalmers Mitchell M.A. "The Geology of the Central Himalaya by A. B. Woodward, F.G.S.

In the vicinity of the island of Pantelleria at a distance of 150 metres from the western shore (depth of about 30 m.) have been discovered several sponge deposits.

Five Greek vessels, with two divers in 3 days obtained 25 quintali of sponges of the finest quality.

From a circular that has been issued by the Prefect of Catania we learn that the lava streams caused by the present eruption have destroyed vast areas of fertile country, reducing to the most abject poverty many thousands whose only means of sustenance was directly derived from the produce.

Both the Government and the king have already come forward and by munificent gifts have done much towards alleviating the distress.

According to Sir Joseph Fayrer, studies of the chemistry of snake poison have even yet revealed no antidote. When the full effect of the bite has been given, remedies avail little, though the virus in small quantities may be counteracted. In India the average annual loss of life from snake bites for the eight years ending with 1887 was nearly 20,000 persons and more than 2,000 head of cattle, the cobra being the most dangerous reptile. To reduce the evil, it is suggested that the habits of the snakes be made better known, and that a bounty be given for each poisonous snake killed.

On the 21st of July last a most unusual phenomenon was witnessed in the Maltese Islands when a thunderstorm broke over the island, raging for twelve hours and depositing 3 inches of rain. It is fifty-five years since rain fell in the month of July.

A new islet has been pushed above the surface of the Caspian, near Baku. It is $3\frac{1}{2}$ miles from shore, measures 175 by 100 feet, and rises about 20 feet above the water.

Much interest was evinced in these islands during the early part of last month at the close proximity of the planet Mars. This world has been rapidly approaching us since 1877, and it was on the 3rd inst. that it was nearest to our globe. Although 35,000,000 of miles away, the light which it gave forth was of unwonted brilliancy.

Some of the principal points that astronomers are directing their attention to upon the present occasion are its polar snows, and the canals which traverse its continental masses. It is said that water is existent in the planet. This is being tested by a method which will place the point beyond dispute.

Several attempts have been made to introduce the tobacco plant into the Maltese Islands, each of which was attended with a considerable amount of success as both the climate and soil of the islands are peculiarly fitted for its cultivation. Unfortunately however, the experiments were never followed up owing to the difficulty experienced in naturalizing the cochineal insect. The difficulty is, however, one that might be easily overcome by the introduction into the islands of the proper species of *Opuntia* upon which the insects depend for their support and the way might thus be opened up for the establishment of a thriving and lucrative industry.

On the 3rd ultimo an unusual phenomenon consisting of an enormous waterspout occurred in the harbour of Trieste between the Giuseppino Mole and the lighthouse. It presented the appearance of an immense dark grey pillar of cloud, and after lasting ten minutes it finally broke near the quay doing considerable damage to the street traffic and the houses. During the period that it lasted the atmosphere was so dark that it was found necessary to resort to artificial light in the city.

The heat in the Mediterranean during the last month was very intense, and being accompanied by "black sirocs" it was exceptionally trying to animal and plant life. On the 1st. ultimo a strong Scirocco blew throughout Algeria, and caused the thermometer at Mustapha to register 106° Fah.

With few intermissions it has continued thus for the greater part of the month, and serious anxiety is now being expressed lest there should be a water famine. In the provinces of Algiers and Oran, forest fires have broken out, and it has been found necessary to call in the soldiers to assist in checking their progress.

14 SEP 92



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To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Secretaries of Societies are invited to forward us reports of their proceedings; and Curators of Museums will confer a favour by informing us of any new and important additions that may be made to their collections.

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Supposed Quaternary and since submerged volcano of Mergellina, at Naples.

On entering the Bay of Naples by steamer the first thing which must have struck every geologist—leaving aside Vesuvius for the present—is the line of flat topped hills stretching along the northern shores of the Bay, from Cape Posillipo to the Chiatamone, above the Castel dell'Uovo, their summits in no place exceeding from 160 metres to 200 m., in height except at the Castel Sant'Elmo (224 m.) while they extend inland from the Vomero to the culminating point at the old Camaldoli convent, above Gianura (455 m.) These hills are essentially constituted of irregular strata of ochreous-yellow volcanic tufa of various tints, passing on the one side to pale yellowish-white, and on the other to yellowish brown. This tufa is accompanied by frequent alternating beds of extremely fine volcanic ashes, and others often exclusively formed of impure-white or ash-gray pumice stone in angular pieces, ranging from less than a quarter of an inch to several inches across, and adhering slightly together, though easily separated by the hand. Fragmentary pumice stone also exists in a certain proportion as a constituent part of the volcanic tufa itself, parting in general in such case of the coloration of the rock in which it is imbedded, being of a yellowish-brown, and only in some places white, for instance near Piedigrotta. Sometimes the pumice stone is dark yellowish-brown, this variety, as well as the paler kind, being much decomposed, or what might be called in ordinary language rotten so as to crumble when an attempt is made to detach it from the enclosing rock, for it is only when the pumice stone retains its original whitish or ash-gray appearance that it preserves any con- I have for many a long year been led to believe that this tufa was produced by a volcano situated at a short distance from the Mergellina, but now submerged and no longer recognizable.

Possibly we may be shortly able to clear up this difficulty, a most unexpected discovery having been recently made in the very heart of Naples, and one to which I am led to attribute considerable geological importance.

At the present time a large main sewage drain is being driven through the soft tufa rock from the South-eastern part of the city to the vicinity of Fuorigrotta, outside the city to the north-west under the Villa Montfort, at the lower end of the Parco Gripo, close to the Corso Vittorio Emanuele the sewer is situated at the level of 13m. 70cm. above the sea; 250 farther north, close to the new International Hospital, it is slightly more than 13m. above the sea level; the surface of the ground above being respectively 100m. and 65m. at the points alluded to. Just under the Villa Montfort trachyte rock was met with 40 m. of it having been already bored through, while at the surface not a trace of such rock was ever suspected to exist, volcanic tufa alone being seen, nor did it ever come under any persons observation that trachyte should anywhere be met with in the tufa hills I am describing. The trachyte, which I have carefully examined, is of a dark lead-gray or bluish colour, and equal to the hardest and most compact kind found in any part of the Phlegrean Fields, being of identical structure to some met with at Pozzuoli, and like it enclosing small crystals of sanidina, or glassy felspar. Attiguous to the trachyte, and for a certain distance from it to the south-east the tufa is very puniceous, and large loose blocks of trachyte of a yellowish tinge are to be found imbedded in the middle of the tufa, from which they do not essentially differ in colour. Sometimes the tufa adheres firmly to the trachyte, which might lead us to suppose that the latter must have fallen on the surface of the tufa before it had had time to be perfectly cooled. M. Guisti, the engineer in charge of the works at this point, kindly gave me the following data. After leaving the ordinary yellow tufa common to these hills some beds of good yellow tufa were pierced, then rather clayey tufa; after which dark yellow tufa containing large fragmentary pieces of undecomposed pumice stone, a variety peculiar to this neighbourhood; then a gentle synclinal of white tufa, each of these several beds being but a few metres in thickness. After this followed 30m. of puniceous

tufa, containing large loose blocks of trachyte, followed by the trachyte rock *in situ* above alluded to.

Have we not here the evidence of the existence of a volcanic eruption of simultaneous origin to the quaternary though it cannot yet be decided whether it ever reached the surface, or whether there were not some lateral veins, or blind dyke, which forced its way up those the already existing tufa. The subject offers much interest, and I hope sistency, or is of any economic value.

It will be immediately observed, on the most superficial examination, how remarkably irregular the bedding of even the thickest strata is, as they rapidly thin out, and often disappear altogether, to be replaced by others of very different lithological structure. As if to add to such irregularity, the dip of the beds is very varying and inconstant; in one spot it appears to be horizontal, a few yards beyond it is not unfrequently undulating, and further on inclined at a high angle—suggesting the probability of upheaval and giving way of the strata through local volcanic agency, exerted at a very slight depth below the surface and frequently repeated.

In quarrying the tufa as a building material, invaluable on account of its remarkable cheapness 5 pieces of a roughly parallelopipedal shape together measuring about two cubic feet, being worth only a franc—the greatest difference is found to exist in the coefficient of resistance to pressure and crushing strain, according to the locality and series of beds whence the stone is procured. One point, however, is found in common; it was all bedded as a littoral deposit and in shallow sea water, and in confirmation of this fact large oyster shells may sometimes be met with in it. Lead-gray volcanic tufa is largely developed at the southern entrance to the Bay of Naples, around Sorrento, but it is nowhere to be met with on the north side of Vesuvius, or beyond the region I am describing in the direction of Pozzuoli or in the islands of Procida or Ischia.

Topographically the tufa hills of Posillipo and Naples continue in the direction of the old Camaldoli convent, in which neighbourhood scoriaceous and other lava is largely developed; in other directions these hills have no connection with any others for towards Vesuvius and in the direction

of Caserto they die off gradually, and the plain at their foot is but slightly above the sea level: From Cape Posillipo as far as the Vomero, above the Grotta di Pozzuoli, the hill is saddleshaped, with a long, narrow, ridge at the summit, and sloping down at a considerable angle on either side to the base. At the distance of half a mile from the mainland beyond Cape Posillipo is the little islet of Nisita, 180 m. high, and which is simply a small volcanic cone, with a crater broken down on the side looking towards the entrance of the bay, the rock consisting of volcanic tufa.

It has always been a question to me whence this prodigious mass of tufa overlooking the Bay of Naples was ejected. Certainly not from Vesuvius or Monte Somma, far less from certain other volcanoes, such as the Solfatara, the Astruni, or Agnana, which have not the least topographical connection with the hills of which I am speaking, and no denudation has taken place to authorize such a supposition; most improbably also from Gisita, which, besides its insignificant proportions occupies too eccentric a position. For my part some day to be able to communicate further information regarding it. I am led to conclude that the central crater of this volcano must have been situated within a mile of the present coast line in a spot now occupied by deep water, the cone having subsided since the quaternary period. Should my conjecture be found admissible we might apply the name of Mergellina volcano to this trachytic ejection, and we might then be authorized to regard the tufa hills of Naples, as Sasillino as having had their origin thence. Both the trachyte and the yellow tufa are rocks common to all the volcanoes of the Phlegrean Fields and the neighbouring islands while leucitic rocks characterize Monte Somma and augite and Vesuvian leucite rocks.

While speaking of the neighbourhood of Naples I may just give the results of a few very careful observations I made this spring of the temperature of several thermal springs and fumaroles, and compare them with former studies.

Casamicciola, Island of Ischia.—*Acqua del Gurgitello*; February 1869, 84°. c. (Jervis); 10th May 1892, 84°. c. (Jervis).

Lacco Ameno, Island of Ischia.—*Acqua della Rita* 1833, 70°. c. (De Rivaz); 1835, 61°. c. (Guarini); 11th

May 1892, 66°. c. (Jervis).

Barano d'Ischia.—*Fumarola di Saint Angelo*, on the beach; February 1869, 100°. c., (Jervis); 11th May 1892, 100°. c. (Jervis).

Casamicciola.—*Stufe* or *Fumarole di Castiglione* 1822, upper fumarole 56°. c. lower fumarole 66°. c. (Del Giudice); 11th May 1892, lower fumarole, 56°. c. (Jervis).

Pozzuoli.—*Fumarola della Bocca della Solfatara*; February 1862, 93°.4—96°.5 c. (Deville); June 1865, 77°.—96°. c. (Deville); 1865, 96°. c. Fouqué; July 1867, 115°. c. (Goreix); January 1869, 92°. c. (Jervis); 12 May 1892, 95°. c. (Jervis).

Naples.—*Stufe di San Germano*; 1856, 64°—93°. c. (Deville); 1857 and 1882, 61°—97°. c. (Deville); 1857 and 1862, 61°.—97°. c. (Deville); July 1869 85°—96°. c. (Deville); May 1892, 86°. c. (Jervis).

Naples.—*Acqua del lago prosciugato di Agnana* May 1892, 69°—73°. c., according to place (Jervis).

Naples.—*Grotta del cane*; May 1892, 38°. c. (Jervis).

G. JERVIS.

Turin, September 1892.

On *Tryonx Ragusensis*, and *T. Melitensis*.

De Greg. Lydeck.

In a short article contributed to *Il Naturalista Siciliano* Professor De Gregorio says of the above fossils.

"In 1883 I had several fossils sent to me for determination from the Geological museum of Modica, amongst which was an interesting portion of a carapace, which in a note written in 1883 (*Novi Fossili vert. e invert. p. 1*) I called *Tryonx Ragusensis*. I had the specimen figured but I did not publish its description *in extenso*. Mr. R. Lydekker in his paper on a "New species of *Tryonx* from the Miocene of Malta" (1) figures a species which at first sight seems to be analagous to our species. My friend Mr. Negri showed me a few months ago some beautiful drawings of an analagous species from the lower tertiary of Vicenza Monteriale. I believe that all of these forms, as I have remarked in aforesaid notes, are to be grouped with the *Tryonx italicus* SCHAUER and *Henrici* OWEN."

(1) *Quart. Journ. Geol. Soc. v. 185. N. 37. 1891.*

The Phœnicians in the Mediterranean.

The earliest maritime people to appreciate the value of trade between the East and West were, apparently, those living along the south coast of Arabia. Happily situated between the Persian Gulf and the Red Sea, and separated by vast deserts from the great nations of Asia, the Sabæans were free from those alternations of industry and war which are so unfavourable to commercial pursuits; for centuries they possessed the commerce of India, and they became famous for their opulence and luxury. Sabæan ships visited Ceylon and the Malabar merchants supplied Indian goods to Mesopotamia and Syria, as well as to Egypt and Ethiopia. The ships trading to the Persian Gulf discharged their cargoes near the mouth of the Euphrates, whence the traffic passed partly by river, partly by land, to the coast towns of Syria and Palestine, and through the Syrian and Cilician gates to Mazaca (*Kaisariyeh*), and Pterium (*Boghazkeui*); from the last place Indian goods found their way to Sardis and Sinpe. The ships visiting the Red Sea landed goods at Elath, at the head of the Gulf of Akabah, for carriage by land to Tyre and Sidon, and on the western shores of the Red Sea for transmission to Meroë, Thebes, Memphis. At the same time silks from China, and gems from India, were carried overland to Chaldaea and Assyria; and Bactra (*Balkh*), "the mother of cities," rose and flourished at the central point of the transit trade. Egypt, with no timber for shipbuilding, a distrust of all foreigners especially when they came by sea, and a settled dislike of maritime pursuits amongst her people, long neglected the opportunities afforded by her favourable geographical position. Tyre, Sidon, and other Phœnician towns, reached by easy roads from the Euphrates and the Red Sea, and from their situation commanding the Mediterranean, became centres of distribution for Indian goods; and the Phœnicians, gradually extending their operations to the Red Sea, traded with the ports of Southern Arabia, and even ventured to the shores of India. It was in this first period that the Jewish kingdom reached its widest extent. During the long wars of David's reign the Jews obtained possession of the land routes over which the rich products of India were carried to Tyre

and Sidon; and Solomon did all in his power by building Tadmor in the Wilderness (Palmyra), by improving the port of Elath, and by carrying out other great works, to protect and facilitate the transit trade from which such large profits were derived. The Jews do not appear to have been the actual carriers, but many of them no doubt, following the example of their merchant-king, engaged in commercial pursuits, and wealth poured into the kingdom so that silver was made to be as stones in Jerusalem.

In the early portion of this period the commercial prosperity of the Phœnicians reached its culminating point. Their colonies dotted the shores of the Mediterranean, and their ships passed the "Pillars of Hercules" to Great Britain and the western shores of Africa, and floated on the waters of the Red Sea, the Persian Gulf, and the Indian Ocean. The sea-borne trade of the known world was in their hands; wealth flowed into their cities, and in the markets of Tyre tin from Cornwall and amber from the Baltic were exposed for sale with the silks, gems, and spices of the far-distant East.

Phœnicia had sent out her pacific colonies to the remotest parts, and not insignificant vestiges of their handicraft still to excite our wonder and admiration. We have the megalithic temples of Malta sacred to the worship of Baal, the generative god, and Astoreth, the conceptive goddess, of the universe. The three thousand nurhagi of Sardinia, round towers of admirable masonry, intended probably for defence in case of sudden attack, and the so-called giant graves, were as great a mystery to classical authors as they are to us at the present day. Minorca has its talayots, tumuli somewhat analogous to, but of ruder construction than, the nurhagi, more than two hundred groups of which exist in various parts of the island; with these are associated subordinate constructions intended for worship; altars composed of two immense monoliths, erected in the form of a T; sacred enclosures and megalithic habitations. One type of talayot is especially remarkable, of better masonry than the others and exactly resembling inverted boats. One is tempted to believe that the Phœnicians had in view the grass habitations or *mapala* of the Numidians described by Sallust, and had endeavoured to reproduce them in stone;

"Oblonga, incurvis lateribus tecta, quasi navium carinae sunt."

The decline of Phœnicia dates from the establishment of the Persian Empire in the sixth century B.C., and after the capture of Tyre by Alexander its commerce gradually passed into the hands of the Greeks.

On the Occurrence of a Black Limestone in the Strata of the Maltese Islands.

By JOHN H. COOKE, F.G.S., etc.

While engaged in the examination of the superficial deposits of the Maltese Islands, I have often met with rounded pebbles and angular fragments of a black, crystalline limestone, either lying on on the rock surfaces, or embedded in the Quaternary formations.

The late Professor Leith Adams drew attention to the same fact as long ago as 1867, and in a paper which was published in the Quart. Journ. Geol. Soc. he expressed an opinion that the fragments which he had seen lying on the surfaces of the sides and summits of the Gozitan Hills, belonged to a formation that was of a much later age than any of the rocks that are now to be found *in situ* in the islands (1).

Dr. John Murray, too, notes in his brochure (2) on the Maltese Islands the occurrence of similar fragments in the neighbourhood of Marsa Scirocco, and he further adds that no evidences of the rock having been found *in situ* in the island had hitherto been recorded. The remarks of these gentlemen led me to consider the matter attentively, and I have, during the last year, been carrying on investigations with the object of discovering the origin of the black marble, the result of which has been to show that it is but a variety of the Lower

(1) Dr. Adams says, "Indications of more recent beds are seen in the blocks of weathered limestone known as Gozo marble which are seen strewing the valley eastward of the lighthouse on the northern shore, and in fragments of a black limestone or marble which strew the sides and summits of the Gozo Hills. There can, I believe, be no doubt that these fragments have no connexion whatever with any of the recent formations in the islands."

(2) "The Maltese Islands, with special reference to their Geological Structure," Scottish Geol. Mag. September, 1890.

Coralline Limestone the basement bed of the Maltese series, and that it occurs extensively *in situ* in that formation. In the eastern and south-eastern parts of Malta considerable quantities of rounded boulders and angular fragments of black limestone, that vary in size from a walnut to a medium-sized pumpkin occur in the beds of the gorges, in the soil of the fields, and in all those localities where the Globigerina limestone has been eroded away, and the underlying basement rock has been exposed to view.

In the Quaternary strata, too, of both Malta and Gozo these fragments are especially numerous. The elephant bed in the Benhisa Creek at the south-eastern extremity of Malta affords a characteristic example of their mode of occurrence in the diluvial beds of the island.

In this bed large water-worn boulders, having, when broken, a jet-black lustre, occur at different depths intermixed with boulders and fragments of other colours, eighty per cent. of which are at once recognizable as having been derived from the formation out of which the creek has been formed. They generally lie with their longer axes in a horizontal direction, forming well-defined layers of several feet in thickness, alternating with beds of a rich, red soil, containing the remains of several extinct species of elephants.

It was to this part of the island that I first directed by attention in my search for the origin of the bed from whence these boulders and pebbles had been derived, as, owing to the great amount of denudation to which the country around had been subjected, the whole of the beds, that had formerly overlain the basement rock, had been completely swept away, and the Lower Coralline Limestone had been laid bare over an area of several square miles in extent. The first evidence of the black limestone occurring *in situ* appeared on the road between Bephisa and Uied el Mista. The exact spot is situated directly opposite to Il Mara, at a distance of about 400 yards from the sea cliffs. It consists of a patch of black crystalline marble, which is similar in every respect to the limestone of which the boulders and pebbles are composed. The patch extends half-way across the road, and on the off side a cart-rut has been formed in it to a depth of eight inches. It occurs in division *b* of the Lower Coralline Limestone,

but as no sections were in the vicinity it was not possible to determine its thickness. Judging, however, from a fragment which I detached at the bottom of the rut, and which showed a gradual transition of the black into the characteristic yellow variety of the formation, it is not probable that it is more than a foot. I broke off several pieces and made sections of them, as well as of several of the pebbles from the Benhisa Creek, which is not more than a mile away.

An examination under the microscope showed the specimens from both localities to have a granular texture, with here and there numerous well defined patches of calcite having a semi-radiated structure.

The insoluble residue that resulted after treatment with hydrochloric acid was chiefly composed of siliceous particles, and of flocculent, carbonaceous matter which remained in suspension in the solution for some considerable time. Both were hard, compact, and crystalline; and chemical analysis revealed the presence of sulphide of iron. The specimens were evidently identical. About one mile from this spot, and situated about 200 yards to the west of Ghar Hasan's Cave on the same coast, there is another patch or vein, which is similar in every respect to that to which reference has just been made. It occurs on the cliff edge, and at the western extremity of the first wall which is met with after leaving the cave. It is but small, having a diameter of four feet only and as it does not abut on the cliff face its thickness was not shown.

Neither of the patches were of any great extent, and would not of themselves be sufficient to account for the quantities of blocks and fragments that lie scattered over the rock surfaces in their vicinity. It is probable that they are the remnants of the patches and veins that formerly occurred in those portions of the Lower Coralline Limestone that were broken up when the upper deposits of the district were swept away. As I shall afterwards show when describing the occurrence of similar veins in the Gozitan beds, this black crystalline variety of the basement rock is still very common in the upper layers of that formation. In the Malta district to which I have just been referring these upper layers have been completely swept away, and nearly all traces of black veins

have thus been obliterated.

In Gozo its mode of occurrence may be studied to the best advantage in the Lower Limestone quarries that are situated on the southern coast in close proximity to the church of the Madonna della Kala, and immediately opposite the islet of Comino. (1) Fragments of a red as well as of a black variety are strewn around the hillsides in great number, while quantities of red and of black chippings are to be found intermixed with the debris of the quarry.

The sections that the quarrymen have cut, show that both varieties occur in thin irregular veins of from one foot to three feet in thickness, and from ten to twelve feet in length; or as irregularly shaped patches having diameters ranging from three to eight feet. In some instances several smaller veins ramify from the main seam, and pursuing an irregular course of a few feet in a horizontal direction, they break off abruptly.

It is in and around the "Scutella" seam which forms the capping of the Lower Limestone, that the greatest number of veins and patches seem to occur: they are, however, found in the underlying divisions also.

The varieties of the rock vary greatly in their lithological aspects in different parts of the bed. In the upper divisions they are of a coarse texture and granitic appearance, and their fossil contents consisting of *Orbitolites*, *Echini* and *spins* are plainly discernable; but in the lower parts, their close, fine grain causes them to exhibit an exceedingly homogeneous appearance. Another locality in which the red variety is extensively developed is the bottom of the valley which is situated midway between Ras-el-Hecca and Uied tal Assiri on the northern coast of Gozo. The torrent that tears its way down the bed for a few occasional hours during the rainy season has there laid bare the basement rock, and has exposed a large patch of bright, red limestone that answers in every particular to the rock of which the numerous fragments that lie scattered over the surrounding slopes, are composed.

In common with the other rock fragments with which the country is strewn, there can be no doubt but that these black and red varieties were derived

(1) My attention was directed to its occurrence in this locality by Prof. N. Tagliaferro.

from the island's formations at a time when the forces of denudation were much more active than they are at present. The numerous oscillations of level that the islands bear evidences of having undergone, and the extensive erosion to which they were afterwards subjected by the combined action of frost and rain, are probably to be accounted among the most potent of the forces that assisted in planing down the islands' rocks, and in distributing the debris throughout the Quaternary and the Recent deposits. The thin integument of soil that covers the surface even in those localities where denudation has been the most severe, masks from view the rocks beneath; and this, combined with the fact that but few clean cut sections of the Lower Coralline Limestone are exposed inland, affords an explanation for the obscurity of these thin veins of black limestone, and for the doubt with which their occurrence in the Malta rocks has hitherto been regarded.

Geological Magazine.

Fighting Mice with a Bacillus.

Professor Loeffler's crusade against the field mice of the Thessalian plain has ended in victory. The latest reports announce that the fields are strewn with the corpses of mice. It will be remembered that Professor Loeffler discovered some time ago a new bacillus, the "bacillus typhi murium," which has the power of producing a certain disease in mice, and in mice alone. A plague of field mice, threatening to destroy the harvest, having appeared in Thessaly, he was appealed to by the Greek government, and immediately started for Athens. He began his experiments by treating field mice in the laboratory with injections of his bacillus cultivation, and when these experiments showed his method to be undoubtedly the right one, he started for Thessaly with a staff of Greek doctors. Bread crumbs, saturated with the bacillary substance, were strewn broadcast over certain fields, and as early as a week later the results were visible. Success being now assured, Professor Loeffler will return to Germany, and the bacillus cultivation will be carried on at the seat of war itself. *Scientific American.*

Teeth Food.

In an address on "tooth culture" at a meeting of British dentists Sir James Crichton-Brown referred to the withdrawal of fluorine from our food as one of the important causes of the increase of dental caries. This element seems to find its way into the animal economy only through the silicious steams of grasses and the outer husks of grain, in which it exists in comparative abundance; and the fineness and whiteness now demanded in flour are secured by removing the bran that yielded fluorine to our ancestors. The enamel of teeth has been found to contain more fluorine, in the form of fluoride of calcium, than any other part of the body. Fluorine might, indeed, be regarded as the characteristic chemical constituent of this structure, which is the hardest of all animal tissue, and contains 95.5 per cent of salts against 72 per cent in the dentine; and any deficiency of this element must result in thin and inferior enamel. The question of restoring the supply of fluorine to our diet is worthy of consideration.

The Relationship of the Structure of Rocks to the conditions of their Formation.

BY H. J. JOHNSTON LAVIS, M.D., F.G.S.,

The Presence of Volatile Matter in Modifying the Structure and Composition of Igneous Rocks.—As has already been intimated, those grand explosive eruptions that burst forth after long intervals of complete tranquillity are characterized by an essential ejection of vesicular structure and fragmentary state. On the other hand, chronic activity, even when it increases to the stage of paroxysmal outbursts, is equally well marked by the outflow of a continuous mass of igneous magma, or what is generally known as lava. The vesicular rock masses, or scoria, that cover lava streams are, both in origin and structure, widely, though not completely, different from the pumiceous products of the first kind of eruption. These assertions hold true almost without exception in the case of basic rocks, and are exceedingly common even amongst the most acid ones. Most of the illustrations that will be brought forward have been chosen from among basic rocks, since, so to speak, *crisis* between a vitreous, fine, vesicular, and fragmentary state on the other, is easily attained, and is well defined.

Monte Somma Vesuvius	Roccamonfina.	Monte Vultura.	Monte Nuovo.
PHASE ? Introductory explosive stage. Problematical.	Same.	Same.	Introductory explosive stage. At first, ejection of highly vitreous and microcrystalline (excluding plutonic-formed minerals) pumice followed,
PHASE I.—Chronic activity, outflow of leucitic basalt, lava, scoria, ash, &c.	Same. Leucitites	Same. Outflow of basalt, Hailyne basalt, and leucitic basalt.	later by more compact and almost continuous outflow of Phonolite.
PHASE II. — Inactivity, denudation.	Same. Leucoteprites	Same.	
PHASE III. — Violent paroxysms, dwindling into next phase.	Same.	Same.	
Production of basalt pumice and pumiceous scoria towards the end.	Production of leucite, pumice and pumiceous scoria towards the end.	Production of Hailyne basalt pumice and pumiceous scoria towards the end.	
PHASE IV. — Apparent return chronic activity. Leucitic basalt lava (small in quantity).	Same. (abundant.)	Same. (Abundant production of Hailyne basalt lava.)	Apparent extinction.
PHASE V. — Inactivity, denudation.	Same.	Same.	
PHASE VI.—Violent explosive eruptions. Production of basalt pumices.	Same.	Semi-explosive eruptions of pumiceous scoria, forming the present lake basins. Hailyne basalt very similar physically to Phase VII., period 5 of Vesuvius.	
PHASE VII.—Less violent, dwindling into next phase.	Production of andesitic ash in enormous quantities.		
Production of leucitic basalt pumices and pumiceous scorias towards the end.	Eruption of large quantities of andesitic lava.		
PHASE VIII. — Chronic activity, outflow of leucitic basalt lava.			

From this Table we learn that a series of intermissions take place in the activity of a volcano; that following these intermissions we have the production of fragmentary pumiceous scoria stage to that of true lavas. The striking resemblance between the phenomena of the three first-named volcanoes up to a certain stage cannot but strike the observer as very remarkable, and opens a wide field of investigation, for it is quite certain that similar stages in each of these volcanoes were not contemporaneous.

The igneous magma, whilst confined below may have undergone partial crystallization before it reaches the surface. In that case, however rapid the ejection and cooling be, the ejectamenta will always contain those *formed* materials, as seems to have been the case with sanidine, amphibole, and, perhaps, other minerals in all the pumices of Vesuvius, Mt. Vultura, Roccamonfina, the Campi Phlegrei, Ischia, &c. In case of the magma containing a large amount of diffused (2) the sudden and rapid conversion of this into the gaseous state

will immediately result in the swelling up of the magma into a spongy mass splitting it up into fragments of various sizes by the partial escape of the gaseous contents, and rapidly absorbing an enormous amount of heat. In consequence, the mass solidifies before time is given for the conversion of the vitreous into the microcrystalline or crystalline state, or, at the most, only allows such to take place imperfectly. As a result of the rapid solidification, many of the bubbles of gas are unable to escape from the mass, except where near the surface. We must remember that the change of pressure is not only from that of the original magma to that of the atmosphere at the earth's surface, but the low pressure reached, by the ejectamenta, many thousands of feet, or even some miles upwards, to which height the materials are projected; and even if that were not sufficient, the rapid cooling by contact with the cold air in falling would complete the refrigeration. That such is really the case we have certain proof of in the preservation of organic and easily fusible substances of Pompeii. The actual physical structure and mineral composition of a pumice will depend on—

- (a) Composition of the original magma.
- (b) Pre-eruptive temperature of same.
- (c) Amount of enclosed volatile matter.
- (d) Amount of pre-eruptive crystallization.
- (e) Rapidity of ejection.
- (f) Height of projection.
- (g) Temperature of the air.

The ejection will take place at first with great rapidity, but will diminish as the tension in the whole unescaped mass is relieved. But beyond this the upper portion of the injected igneous magma column will be more exposed to aquiferous strata than that farther removed from the earth's surface; and consequently the expansion, and the results dependent upon it, will be most marked in the portion of the magma near the surface, and also it is probable that that part richer in water will be lighter, and rise to the top of the column. This part having escaped, those portions that follow it will be hotter from diminished loss of heat, from the less amount of diffused water it has raised

(2) The formula is here used as it does not refer to any definite physical state of the compound represented by it as does steam, vapor, water, etc.

to its own temperature, and also from the less to be converted into steam: the latter will escape more slowly, and will reach a less height, all circumstances favourable to the slower cooling and less vesicularization of the magma. The consequence is, that we must expect more crystalline and denser ejectamenta generally in larger fragments, which I have called pumiceous scoria. Should the eruption not terminate at this point, the conditions favourable to slow cooling, more complete crystallization, and continuity of mass, may proceed to such a point that the igneous magma may pour forth from the vent, forming lava streams of vast extent, so that years may be occupied in cooling, or the magma may be kept simmering in the volcanic chimney, presenting the characters of strombolian action. Monte Nuovo is a good illustration of the former case, although the lava hardly reached the point of flowing out as a continuous mass. The progress of events, as above described, is fully borne out by the investigations of the physical structure and composition of rocks, whose mode of formation we can judge of by historical accounts, by collateral facts, and by analogy. I first discovered that an eruption of explosive type produced a deposit of pumiceous nature, divisible into three sections, at Vesuvius, (1) and I have been able to verify the same facts at Roccamonfina, Mt. Vultura, Monte Nuovo, San Stefano, Ventotene, Ischia, and many other volcanoes, in at least a hundred different eruptions. In the second part of this paper I propose to bring forward typical examples from each locality in illustration of this.

(to be continued.)

A strange March to the Sea.

At irregular intervals of ten or fifteen years, a mighty army appears in parts of Northern Europe,—such as Lapland, Norway and Sweden,—coming so mysteriously that it is regarded as having rained from the clouds. It consists, of vast hordes of straight line, attacking any enemy in their path little, dark, mouse-like animals that travel in a crossing lakes and rivers, and turning aside only

(1) "Geology of Mt. Somma and Vesuvius," &c., Q. J. Geol. Soc., Jan. 1884.

for a smooth perpendicular wall or rock. They devour vegetation generally, utterly devastating the country over which they pass. These creatures are lemmings, which have increased to enormous numbers, until, seemingly made desperate by hunger, they leave their usual haunts, and, prey upon by bird, beast and fish, with constantly thinning ranks, make their irresistible march across the land, to end usually in almost total annihilation in the sea. The lemming is scarcely six inches long, yet even in its forest home it fiercely disputes the passage of man or of dog. It belongs to the same subfamily of rodents as the vole, or short-tailed field-mouse, which has caused great destruction in Scotland during the present year, and which is said to exist in greater numbers than any other mammal in Europe, Asia and America.

"Left Handed" Snails

Physiologists have found it a difficult matter to account for the facts that most people are right-handed and a few left-handed. In a recent work, Sir Daniel Wilson concludes that left-handedness is due to an exceptional development of the right hemisphere of the brain, and traces the phenomenon back to the early stone age, certain implements indicating that paleolithic man was sometimes left-handed, and certainly was not ambidextrous, as some have maintained. Among the lower animals are individuals that use the left limbs more readily than the right. Dr. D. G. Brinton adds that, while it may sound like a "bull" to talk of animals as left-handed who have no hands, the same physiological phenomenon is observed in snails. In them it is manifested as a reversed twist of the shell. With the ordinary vine snail the spiral curves from left to right, but in one specimen in about 3000 the curve is from right to left; and in certain other mollusks examples are far more common.

The Depths of the Mediterranean and Black Seas.

By RICHARD BEYNON, F.R.G.S.

(Concluded.)

From 80.8° F. to 69° F. was the thermometric range in the first 27 fathoms. In the next 27

fathoms the temperature fell to 62.5° F. The for depths between 110 and 547 fathoms was 59° F. to 57° F. At the lowest depth found (2406 fathoms) the temperature was 56° F., which, as previous investigators have established, is the approximate uniform temperature of the bed of the Mediterranean. One very curious result of the temperature experiments was the finding of water whose temperature was 52½° F., at a depth of 415 fathoms, at the junction of the Adriatic with the main waters of the Mediterranean Sea.

It has been found that the temperature of the Mediterranean Sea bed is by no means constant, and, according to some authorities, varies slightly in accordance with the mean temperature of the winter preceding the season in which the temperatures of the sea bottom are taken. Thus in 1871 the *Shearwater* expedition, under Captain Nares and Dr. Carpenter, found a bottom temperature at 1650 fathoms of 56°, and the year previous the same temperature had been met with at a spot where the sea bed was 1743 fathoms from the surface. In 1881, however, Captain Mangnaghi, Hydrographer to the Italian Navy, along the Professor Giglioli, in the surveying vessels *Washington* found the bottom temperature to be 1° higher than that recorded as the mean of those obtained in 1871. The mean temperature of the months of December, January, February, March, and April is 53.6° F. at Toulon and 56.84° F. at Algiers, and the average of these two temperatures gives approximately the degree of heat contained in the Mediterranean Sea bed between those two places.

With regard to the Adriatic Sea, soundings show that only one-third of its area can be regarded as forming a part of the Mediterranean basin proper, the remaining portion not averaging more than 50 faths. in depth. A channel of 400 fathoms in depth stretches across the entrance to the sea, from Otranto to Albania. Within the sea the depth increases until a maximum of 765 fathoms is attained, and this rapidly shoals until the comparatively shallow waters of the northern portion of the sea are encountered. The *Pola* made some interesting experiments relative to the transparency of the Mediterranean waters. In three cases a white disc was seen down to a depth of 177 feet. Where the water was deepest, however, invisibility was reached at 105 feet.

The paucity of animal life in the great depths of the Mediterranean is well known. Its depths are to a certain extent stagnant. There is an utter absence of that vertical circulation so thoroughly developed in the Atlantic, and which results in process of time in every particle of water being alternately transposed from sea bed to surface, and surface to sea floor. The only semblance of such a circulation that exists in the Mediterranean is caused by the descent of water that has been concentrated by evaporation on the surface, and has thus had its specific gravity raised above that of the underlying strata. But the descent of this water will be seriously interfered with at a depth of 200 or 300 fathoms, where the temperature is such that it will encounter an aqueous layer whose specific gravity is much akin to its own.

It will be remembered that it was owing to the absence of life met with during the researches of Professor E. Forbes in the *Ægean* Sea, that the erroneous doctrine was formulated that marine oceanic life ceased at a depth of about 300 fathoms.

Subsequent explorations in the deep sea speedily showed the fallacious character of such a conclusion, except in enclosed seas of the Mediterranean type.

In the western basin of the Mediterranean, the bottom consists chiefly of clay, of a grey or brownish colour. It always contains some carbonate of lime, the remains of foraminifera. Both in appearance and chemical constitution the mud resembles that dredged up in the open ocean from areas which are shut off by submarine ridges from free participation in the vertical oceanic circulation.

In the eastern section of the Mediterranean the sea bed deposits contain a considerable proportion of volcanic ash and other constituents of igneous origin.

Before proceeding to discuss the character of the connecting channels and currents that unite the Mediterranean Sea with the Atlantic Ocean and the Black Sea, we will briefly allude to the findings of the latest researches conducted in the waters of the last named sea.

The Russian gun-boat the *Tchernomoretz* was engaged in June and July, 1890, in the work of surveying. The maximum depth, 7365 feet, was

found in the central portion of the sea, between the Crimea and Anatolia. The explorations were continued last year, and the results of the previous year's work were confirmed. The 100 fathom line was found to lie close to the shores of the Crimea and Anatolia, and the axis of greatest depression has a direction from south-west to north-east. The steepest coast was found at Rizo, where the angle of inclination attains 10° . The most interesting of the recorded observations are those relating to the temperature of the Black Sea waters. The variations of temperature at the surface range from 77° F., to 41° F., while on the northern shores the thermometer sometimes falls below the freezing point. The annual variations of the temperature, due to the seasons, do not penetrate deeper than 100 fathoms. At a depth of from 30 to 175 feet the temperature was 57° towards the south coast, 54° in the centres, and 52° near the east, west, and north shores.

The water begins to be warmed by the air in the month of May, and during August the mean temperature of the surface water is higher than that of the superincumbent air. The variation of temperature for depths below 180 feet is very peculiar. At this point the thermometer registers 45° F. Then the thermometer begins to rise, and at a depth of 6000 feet it shows 49° F. For all depths below 200 fathoms the temperature may be described as constant, and lying between 49° F. and 48° F. The most distinctive feature of the Black Sea, however, is that at the depth of 450 feet distinct traces of sulphuretted hydrogen occur. The quantity increases with the depth, until at 600 feet it is quite sensible, and at the mean depth of 940 feet it renders animal life quite impossible. Some even place the inferior limit of organic life at so high a level as 100 fathoms. Dredging shows that at one period of geological history the Black Sea contained an abundance of low organisms, and the semi-fossil shells of certain molluscs characteristic of the brackish water of the lagoons of the Caspian and Black Seas are much *en évidence*. These fossils are doubtless the remains of the Pontic fauna of the Pliocene period when the Black Sea basin was not connected with the Mediterranean. The salinity of the Black Sea was then by no means so great as it is now. When the connection between

the two seas was made, the water from the Mediterranean would make its way as it does at present into the disappearance of the ancient fauna. Thus the sulphuretted hydrogen is one of the products formed by the decomposition of the older life, and as the water in the great depth is practically stagnant, *i.e.*, quite motionless, it follows that the decay is an exceedingly slow process.

Assuming that the water which annually flows through the Bosphorus into the Black Sea forms a one-thousandth part of the total contents of the sea, it will take 1000 years to completely renew the whole contents of the basin. It will be thus easily seen to what small extent the deep waters participate in the scheme of circulation. The Sea of Azov is merely the expanded mouth of the River Don, its waters being shallow, having no greater depth than $7\frac{1}{2}$ fathoms, and being thoroughly mixed by each storm that visits it.

The Sea of Azov, too, shares in the disturbing influences of the surface current which sweeps round the shores of the Crimea to the north-west and then follows the trend of western shores past the mouths of the Danube towards the Bosphorus. The dimensions and velocity of this current are augmented when the melting of the snow in the Black Sea basin is more rapid than usual.

We have mentioned above that a decided influx of Mediterranean water takes place into the Black Sea. Were it not for this saline water the Black Sea would be much fresher than it is, and were the connection between it and the Mediterranean destroyed then the sea would become fresher, as there is a surplus of river and rain supply over evaporation. Throughout the whole length of the Bosphorus, the Sea of Marmora, and the Hellespont, two distinct currents can be traced, the heavier Mediterranean water forming the underlying stratum, moving slowly *into* superincumbent and moving in the opposite direction. There appears to be very little mixing of the two currents, the layer of demarcation between the two being easily detected by the difference in the specific gravities of the two aqueous masses.

The comparatively fresh water that the Black Sea contributes to the waters of the Mediterranean produces but little effect, so large is the area of the basin into which it pours itself and so small relatively is the volume of water so contributed.

The greatest depth of the Sea of Marmora is found along the line connecting the Hellespont with the Bosphorus, and ranges between 266 and 355 fathoms.

The Hellespont itself has a depth of 50 fathoms, while the mean depth of the Bosphorus varies from 30 to 40 fathoms.

The Aegean Sea has not its specific gravity reduced as might be expected below that of the whole Mediterranean by the influx of the Black Sea water. In fact its specific gravity is greater than that of any other section of the Mediterranean basin.

The accompanying table bears out the truth of this. The figures quoted are the result of many observations, and are derived from samples of water taken from 50 miles to the westward of Gibraltar to the easternmost section of the Black Sea.

Mediterranean Water outside } Gibraltar.....	1'0260 — 1'0270
Mean specific gravity for } Western Section.....	1'0280 — 1'0290
Mean specific gravity for } Eastern.....	1'0290 — 1'0300
Mean specific gravity for } Black Sea.....	1'0120 — 1'0140

In each case the results are derived from analyses of surface water.

In round numbers the area of the Mediterranean basin is one million square miles, and the average rain fall over the whole area that drains into it has been assessed as being equivalent to an annual rain-fall of 30 inches upon the sea itself. The amount of water removed by evaporation is greatly in excess of this, probably $2\frac{1}{2}$ times as great. At Rome the evaporation is represented at some 105 inches per annum, at Madrid it is 65 inches, and at Cairo 92 inches. It does not require much speculation to determine what would happen if the waters of the Mediterranean were not replenished from some external source. A shrinkage of the basin by a diminution of the water area would continue until the evaporation from the reduced surface would equal the amount of aqueous precipitation. But before that condition would be reached, the shrinkage would have resulted in the drying of the bank between Africa, and between Africa and Gibraltar, with the result that two "dead" seas would be formed.

Happily, there is not much probability of such a

change taking place, for the Mediterranean is supplied with water from the Atlantic as well as the Black Sea. Through the Straits of Gibraltar there flows two currents as there do through the Sea of Marmora. The existence of an outward current has been long known. It is accountable for the higher temperature found in the deep waters of the Eastern Atlantic. Water, unmistakably of Mediterranean origin, has been found some 200 miles north-west of the Straits at a depth of 1560 fathoms. Its presence at such a depth is readily understood when it is remembered that the water of the Mediterranean contains an average of 3.9 to 4 per cent. of solid matter in a state of solution while the percentage in Atlantic water in the vicinity of the Mediterranean entrance is 3.4 to 3.5.

It has been calculated that the *inflow* through the straits is equivalent to a river eight miles wide, 100 fathoms deep, running with an uniform velocity of $18\frac{1}{2}$ miles in the twenty-four hours. Such are the dimensions of a current requisite to maintain equilibrium between the contribution of rivers, precipitation supply, and the inflow from the Black Sea on the one hand, and the copious evaporation and the outflow into the Black Sea and the Atlantic Ocean on the other. *Knowledge*

Prehistoric Items.

Nothing is more interesting than to speculate upon the social condition of those rude progenitors of the human race whose history, until our own epoch, has lain shrouded in the night of Time.

For the most part, all is mysterious and enigmatic concerning them; yet, owing to the researches of the archeologist, the geologist, and last, but not least the student of botany, we are enabled in some degree to penetrate the gloom. We can tell with what implements they went a-hunting, with what material they made their clothes, and what food they ate. The botanist can even inform us how the prehistoric host adorned his little feast; the rates he offered his guests for grace rather than for need; the dessert he set before a wedding party, and the provender he placed before the no less joyous convivialists bidden to rejoice over the advent of a first-born! These archaic boards were not so scantily furnished as we might suppose.

Foremost figured the time-honoured pear and apple; the homely fruits, so dear to schoolboys of all ages and all countries, we now know delighted the palates of children born ere recorded history began. The prehistoric area of the apple was chiefly in the region lying between Trebizond and Ghilan. The lake-dwellers of Lombardy, Savoy, and Switzerland made great use of apples. 'They always cut them lengthways, and preserved them dried as a provision for the winter,' writes Decandolle in his interesting work on the *Origin of Cultivated Plants*. Two varieties of apples seem to have been known to the lake-dwellers before they possessed metals. Whether they ever solved the problem that hopelessly puzzled George III, and got them into a dumpling, archaeology does not as yet inform us. The abundance of the fruit found in prehistoric stores would seem to indicate some kind of cultivation.

The pear is of less frequent occurrence, although it is found in the prehistoric dwellings of Switzerland and Italy, usually in a dried state and cut lengthways. Then, as now, therefore, the pear was a greater luxury than the apple. The abundance and variety of names testify to the very ancient existence of the latter from the Caspian Sea to the Atlantic. Philology comes largely to our aid in this interesting study. The more ancient and widely spread a plant, the more numerous its names.

But prehistoric diners-out possessed one of the best of all fruits, the grape. Seeds of the grape have been discovered in the lake-dwellings near Parma, dating from the age of Bronze; also in the prehistoric settlements of Lake Varese and of Switzerland. M. Decandolle, moreover, informs us that vine-leaves have been found in the tufa near Montpellier, where they were probably deposited before the historical epoch, also in the same formation in Provence. Whether they combine the two we know not, but it is quite probable that wine and walnuts delectated the palates of primitive feasters.

The walnut is of great antiquity. Walnut leaves have been found in the quaternary tufa of Provence, and a species of walnut in some of the Swiss lake dwelling. The species possesses a Sanskrit name, a fact testifying to its early cultivation in India. The tree was introduced into China about 140 B.C.

Only one cherry-stone has been as yet found in any prehistoric settlement of Italy or Switzerland, nor is the antiquity of the stratum quite certain.

One of the most curious and suggestive discoveries in this field is that of the poppy. Were, then, these rude fishers and hunters troubled with carking cares, low spirits, and melancholia, as well as the worn-out brain-workers and anxious bread-winners of the nineteenth century? Was there perhaps a Boleride or a De Quincey among the Swiss lake-dwellers of the age of Stone, some dreamer hopelessly wedded to opium? The capsule of the poppy has been found in these primitive abodes; whilst its numerous names in the language of antiquity prove its ancient origin. Besides Sanskrit, Persian, and Arabic names, several exist in the Slav languages.

Tobacco-smoking in America was very common in ancient days, and pipes of wonderful workmanship have been discovered in the tombs of the Aztecs. The use of tobacco in Western nations, however, dates from the discovery of America, so that it is not to be taken into account here. When we come to vegetables, and what is generally summed up under the head of farinaceous food, we find that our lake-dwellers fared not so badly after all. In the age of Bronze, the ancient inhabitants of Switzerland and Italy had beans most probably served up with bacon; lentils also figured in the domestic bill of fare: very likely, the housewife concocted better lentil broth than many a mistress of genteel households nowadays. Nor were nursery puddings and invalid dishes wanting in those early days. The prehistoric cook had several varieties of wheat, millet—of which they made great use—oats, two varieties of six-rowed barley, besides other cereals. It is needless to insist on the interest and value of such facts and conclusions as these, arrived at with patient care and after unremitting investigations. Doubtless, archaeology and palæontology have many more revelations of a similar kind in store for us.

Before leaving a fascinating subject, let us mention one curious fact more. The great antiquity of the cultivation of flax is well known. The prehistoric inhabitants of the peat-mosses of Lagozza in Lombardy employed flax, the *Linum angustifolium*, though ignorant of the use of hemp and of metals. On the other side of the Alps, among the

lake dwellers of Switzerland, the same species of flax has been discovered, this perennial *Linum angustifolium*, now wild in southern alpine regions. Thus, before the arrival of the Aryans in Europe, before metals, even bronze, were known, before hemp and the domestic fowl were known also, civilisation had reached a certain development on both sides of the Alps. Folks wore linen; satisfied their hunger on beans and bacon; and cracked their nuts on high-days and holidays, much as they do nowadays. *Chamber's Journal*.

NOTES AND NEWS.

The "Mining and Engineering News" of the 27th ult. contains an illustrated article on the Malta phosphates from the pen of Mr. John H. Cooke, F.G.S.

Etna has been in active eruption during the whole of last month, and a considerable area of land planted with the vine and chestnut has been devastated.

At the Botanical Congress which met in Genoa on the 5th ult. the most eminent botanists of Paris, Berlin, Jena, and St. Petersburg were present. Dr. Caruana Gatto represented Malta.

At the annual meeting of the British Association for the Advancement of Science, Dr. G. K. Knott gave a report on earthquake phenomena in Japan. Among the effects of the recent severe earthquake were mentioned the depression of a valley by about 19 feet for a distance of 30 miles,—thus forming a great geological fault,—together with the destruction of mills, bridges and towns, and the curving of a railway line running along an embankment and bridge in the path of the earthquake. It was stated incidentally that in many earthquakes—though not in this one—oil is overturned and by catching fire causes more damage than the earthquake itself.

Lack of irrigation is regarded by Mr. A. Podolsky as the principal cause of last year's famine in southern Russia. In this region ordinary irrigation works are impracticable, and snow irrigation, as, practised in parts of Siberia, is advised. In winter the inhabitants pile up snow on suitable hill tops, covering it with pine branches, straw, dung,

or even earth and, and, and the water from these banks is led in summer by ditches to the cultivated fields. For southern Russia—where rain supplies about half the necessary moisture—it is estimated that an acre of wheat would be irrigated by 6000 cubic feet of the compressed snow.

A remarkable grotto *Nature* tells us was recently discovered during some mining operations at Faverny.

It is a subterranean gallery of about 1500 feet in length, and ends in a great chamber about 40 feet in diameter and six feet high.

Scientific men have hazarded various conjectures as to the source of the watercourse by which this cavity seems to have been formed.

We are in receipt of the fourth number of the *Rassegna delle Scienze Geologiche in Italia*, a publication which all geologists should have in their libraries. Besides the numerous reviews of the geological literature of the early part of the present year it contains an account of the history and development of the Geological Society of Italy, biographical illustrated sketches of the late Professor F. Giordano, and Baron A. De Zigno, and an illustrated article on the Eruption of Etna by Dr. M. Baratta.

The researches of many observers, as reported upon by Dr. Buchan, show that the ocean currents cause the temperature of the west side of the Atlantic, at depths from 100 to 500 fathoms to be nearly 10° warmer than at the same depths on the east side. At 500 fathoms, however, the temperatures of both sides are equal, while at greater depths the east side is the warmer. North of the Wyvil Thomson ridge, which is between Shetland and Iceland, stationary temperature is reached at 700 fathoms, below which the water remains at about 29.5° . In the Gulf of Mexico, the water grows cold down to 700 fathoms, below which it is always at about 25.5° . The temperature of the Mediterranean at 200 fathoms is about 56° , and no change is found in going to the bottom, which in places reaches a depth of 1500 fathoms.

Mt. Etna is 10,868 feet high, 90 miles in circumference at the base, and has on its slopes two cities and 63 villages, with a total population of

300,000. About 80 eruptions have been recorded the first mentioned having occurred early in the 7th century B. C. The most disastrous was that of February, 1169, which destroyed the city of Catania, killing 15,000 people. In 1537 the village of Nicolosi was destroyed and a stream of lava ran 15 miles to the sea. In 1669 several towns were damaged, and a fissure nearly 12 miles long, 6 feet wide, and of unknown depth, appeared, and for six months gave forth a bright light and smoke, with a roar that could be heard for 30 miles. The lava covered an area of 40 square miles. In the eruption of 1886, lasting three weeks, cinders fell at Messina, 80 miles away. The abyss of the crater was found in 1877 to be 1000 feet deep and nearly three miles in circumference. In the latest eruption lava has been flowing slowly from five craters.

It is rumoured that the attempt to construct a telescope which shall be capable of bringing Mars within four miles of our vision has not yet been abandoned. M. Camille Flammarion in an article on the subject thinks that something might be done with a very large instrument, if fixed on a peak—a much larger instrument than the Lick telescope, and placed at a much greater height than the Lick.

Paris, he says, is not suitable as it too low lying for immense magnifying power would only magnify the undulations of the air until the image lost all definition.

Unfortunately we are not told how to get the instrument. The 36 inch glass of the Lick telescope took years to make, and was not finished before £ 11,000 had been spent on it.

No power perhaps is absolutely impossible—at present.

A lively correspondence on the subject of birds v. insects has been carried on during the last week in the Malta local papers. The enormous increase of insectiferous pests during the last few years has caused the agricultural industries to decline to an alarming extent and it is urged that the evil has now increased so much as to call for legislation. In the Maltese Islands there are no laws for the protection of birds, and the lower classes of the Maltese being keen sportsmen no opportunities are allowed to either the migratory or the indigenous species of increasing.

The result is the balance of nature has been disturbed, insects are in evidence everywhere, the crops are ruined—and the community suffers.

The fig-tree, of which several varieties are cultivated in Malta, is justly prized on account of its juicy and abundant fruit. The first fig which is called "baitra ta San Juan" or "St. John's fig" ripens towards the end of June on the 24th of which month is the feast of St. John. To prevent the premature fall of the fruit, and with the idea of hastening its ripening, the process known as caprification is employed. A cluster of wild figs is suspended amongst the branches of the cultivated variety by means of a plant *Anni majus* called on this account *Dakra* the wild-fig tree bearing the name of "Dokkara." Numerous diptera (*Cynips*) become covered with the pollen and convey it from one fig to the other.

In his British Association address, Prof. Schuster pointed out that each country has its peculiar share in the advancement of science. France excels in accurate physical measurement, the German universities find their best work in extending and verifying theories, while the distinctive feature of British science is the important part played by the amateur. The amateur is defined as one who learns science as he wants it and when he wants it, Faraday being referred to as an illustrious example. But the modern system of education is making the amateur an impossibility. Under the present examination practice of the old universities, the engine of scientific research may be likened to a thermodynamic machine, in which the amateur supplies the steam and the universities the cold water! One great function of the scientific associations is to discover and encourage the amateur. They have often given important places to deserving amateurs—that is, to those who do not follow science professionally, and probably lack collegiate training, but who for that very reason are apt to approach a given study with greater freshness and originality, though with less fullness of knowledge.

An interesting natural formation is, the same paper tells us, situated in the southeast of the Valley of Mont Dore.

It is crater-shaped depression about 80 ft. wide communicating by a central hole with a large circular cavern 170 ft. in diameter the bottom of which is occupied by a small lake with about 10 ft. of water. The shape is like that of two cups with bases opposed; the lower one being the larger.

Carbonic acid gas is very abundant in the lower chamber. M. Martel and some friends attempted the descent by means of a rope ladder but was unable to get within 13 ft. of the water. Candles, and lights were extinguished, and progressive suffocation was experienced by the explorers.

During the recent investigations that were made by the Survey of the French Government among the deep lakes of France some very interesting temperature results were obtained which shed

much light upon this hitherto little known subject. Most interesting in this respect was the discovery made by thermometer soundings under the ice of the Lake of Annecy when frozen—showing that a large spring of warm water supplied the lake from beneath. The influence of wind in modifying the distribution of temperature was also marked in several instances. The observations of Dr. John Murray in Loch Ness that long, narrow lakes when swept by prevailing winds were much warmer in the summer time at a certain depth than were similar lakes which presented their narrowest extremities to the prevailing winds.

The *Bullettino della Società Botanica Italiana* for this month contains an interesting note by Professor Caruel on the cultivation of *Cynanorhiza coccineum* and also an article by Mr. T. Piaroli on the Biological relations existing between plants and shells, in which the writer comes to the following conclusions.

a. That the protective means adopted by plants have not an absolute value, as they are usefully when the plant is in a complete state of development.

b. In winter and in the beginning of Spring land shells especially the omnivorous species, feed on plants of which the protective organs are but still in progress of formation. In summer these same plants are effectually shielded from their attacks.

c. The voracity of land-shells varies with the climate.

d. Freshwater shells have habits similar to those of the land species.

CORRESPONDENCE.

To the Editor Mediterranean Naturalist.

I was much interested in an account in a late number of your paper, on the subject of monkey language, which subject I have been trying to work out during the past year, in six tame monkeys in my possession. Though they all used sounds like those mentioned, to express similar ideas, yet it is a peculiar fact that three of them from India, appear to talk a dialectical variation of the same language quite distinct from the other three who are bonnet monkeys from I believe, Africa. Again though all these will answer when called to in their own language, yet I quite failed in interesting two Barbary Apes I met some days back, though this may have been due to strangeness and timidity. They seem to have a great many more distinct vocal sounds representing distinct phases of thought than the ordinary domestic animals.

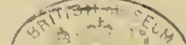
I am sir

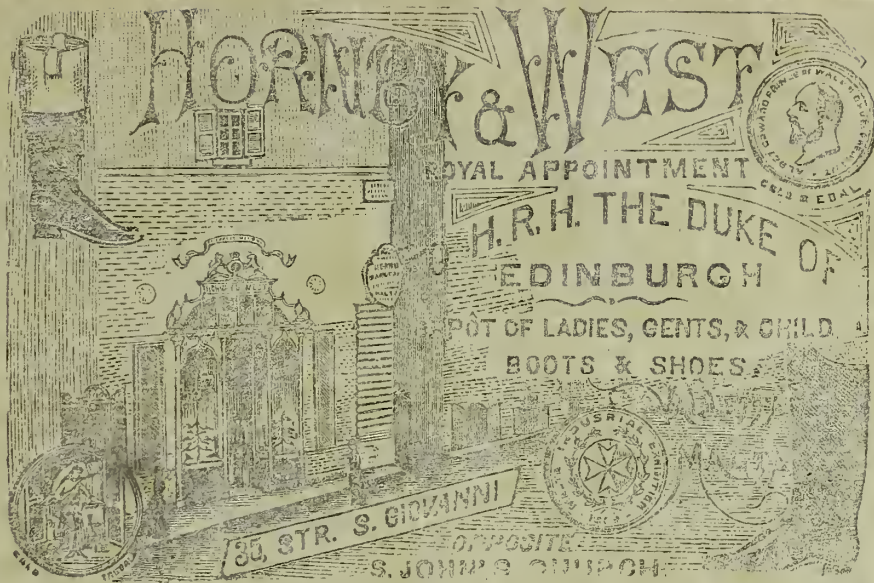
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Assisted by A. CARUANA GATTO, B.A., LL.D.,

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The Mediterranean Naturalist.

A Monthly Journal of Natural Science. Subscription 5/- per annum.

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NOTICES.

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To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

The attention of subscribers is invited to the notice on page 6 of the covers.

On the Occurrence of *Ursus arctos* in the Malta Pleistocene.

By JOHN H. COOKE, F.G.S., etc.

The labours of the late Admiral Spratt, R.N., and of the Late Professor Leith Adams, F.R.S., in the cavern deposits of the Maltese Islands were rewarded by the finding of a unique and interesting land fauna, among which were Elephants, Hippopotami, land Tortoises, gigantic Dormice, and aquatic Birds, the presence of which in so limited an area was incompatible with the present existing physical conditions of the Islands. While carrying on his work of investigation in a cave in the Zebbug Gorge, Uied-il-Kbir, in 1859, Spratt noticed that many of the remains of Elephants that were exhumed presented the appearance of having been fiercely gnawed, (1) and later on when Adams was excavating the Mnaidra gap it was observed that many of the elephantine remains were in a similar condition.

From the situations in which the remains were found, and their condition, these gentlemen inferred that carnivore had lived in the district contemporaneously with the hippopotami; but notwithstanding the most diligent research extending over a period of twenty years, the only tangible evidences in support of their inferences were these gnawed bones. (2)

(1) *Proc. Geo. Soc. vol. XXIII, p. 238.*

(2) *In a collection of fossils sent by Capt. Spratt to Dr. Falconer, a small canine of a carnivorous animal of the size of a fox was present.*

Referring to this subject the late eminent paleontologist Dr. Falconer in a letter to the late Prof. Leith Adams said, "Of the pigmy elephants, I have remains derived from at least twenty individuals, and the entire dentition of every stage from the fetal age upwards, not a single link was missing.

What struck me most, and induced me to defer the detailed account so long, was the absence of large carnivore in the collection. Many of the bones were fiercely gnawed and splintered, certainly by large carnivore, but the species I never determined.

During the Spring of the present year I was engaged in carrying out, with the aid of a money grant from the Royal Society, some excavations in the Har Dalam cavern, a subterraneous gallery situated in a gorge of the same name in the eastern extremity of Malta, and after having excavated six large trenches and obtained some hundreds of bones of *Hippotamus pentlandi*, *Elephas madraensis*, *Cervus barbaricus*, and numerous other animals, I had the satisfaction of discovering an entire ramus of the lower jaw of a Bear, *Ursus arctos* with its canine and molars *in situ*, as well as five other canines belonging to other individuals of the same species.

The Trench in which the jaw and teeth were found is situated on the left-hand side of the cavern, at a distance of fifty feet from the entrance. The floor was strewn to a considerable depth with large boulders, which in some places were heaped up against the sides of the cavern to a height of from two to three feet. Having cleared a space of about thirty square yards, I commenced operations on a friable marly loam, which in this part of the cavern takes the place, as the surface layer, of the red soil that is found farther within.

The excavation which, when finished, measured 12 feet, by 10 feet, by 6 feet, exhibited in section the following sequence of deposits:

- A. A layer of rounded boulders that lay scattered over the floor to a depth of two feet.
- B. Cave-floor consisting of a friable marly loam, about nine inches thick, containing numerous land-shells, roots of plants, limpet shells, a shell of a *Cerethium*, and the vertebrae of a small fish. These latter had evidently been introduced.
- C. A stratified layer of rounded boulders, intermixed with a grey marly loam containing an abundance of land-shells.
- D. A friable marly loam with a few pebbles. Entire antlers, jaws, and limb-bones of *Cervus barbaricus*, together with fragments of very old

pottery, occurred in abundance.

- E. A layer of indurated, light-grey loam containing a few antlers, teeth, and bones of *C. barbaricus*, a jaw and five canines of *Ursus arctos* and remains of *H. pentlandi*.
- F. A layer of about 1 foot 6 inches in thickness, similar in composition to E. but more indurated. Lying at the base of this layer, and on the original rock floor of the cave, were numerous molars, portions of tusks, and limb-bones of Hippo.

The first evidence of the presence of the carnivora was a large canine, the fang of which was unfortunately broken by a blow from the pick of one of the workmen, before the tooth was noticed. This discovery was soon followed by that of a complete ramus of the lower jaw, with its molars, and canine teeth *in situ*.

The peculiar nature of the matrix in which it was embedded unfortunately prevented me from getting it out entire. The articular processes broke off, but a few fragments were recovered and pieced together.

Four other canines were afterwards discovered, each of which was in a fairly perfect state of preservation. One of these Mr. A. S. Woodward, F.G.S. has determined as belonging to the left side of the mandible of a species of *Canis* equaling a wolf in size. Associated with these remains were found several vertebrae and fragments of limb-bones of hippo, and vertebrae and portions of horns of stags; but none of them presented any evidences of having been gnawed.

All of the layers in this section presented distinct evidences of stratification; but in the lower ones the thickness of the deposits and their comparative homogeneity contrast strongly with the numerous thin layers of which the upper beds are composed, and with the assortment of boulders, pebbles, and organic remains of which they are made up.

From the evidences thus afforded it seems that the deposits owe their origin to periodical floodings of the cavern, during which the remains that lay scattered over the cavern floor, near the mouth, were washed further within and were buried in the muddy sediments of the water.

The state of mineralization in which the remains of the Hippo, the Stag, and the Bear are, indicates that these animals occupied the Maltese area

It is to the best of your important investigations that I look most hopefully, i. e. that you may be able to supply the missing forms. Myself and my colleagues (Busk and Spratt) wish you every success in your interesting investigation." In reply to this, Prof. Leith Adams notes. "The missing link however, as regards carnivora, IT WAS NOT MY RARE GOOD FORTUNE TO FIND although I worked hard towards that end."

contemporaneously.

Further researches will, I have no doubt, lead to other discoveries, and it will therefore suffice for the present to simply place on record these, the first tangible evidences of the former occurrence of carnivore in the Maltese area.

Geological Magazine.

The Silkworm in Malta.

It is now nearly 40 years ago since the first attempts were made to establish a silk producing industry in these islands.

Dr. Phipson, who was closely associated with the experiments that were then made, furnishes us with some interesting information regarding them in his little work on the "Utilization of Minute Life", in the course of which he tells us that "In 1854 The Governor of Malta made several reports upon the *Bombyx Cynthia* for the information of the Society of Arts. It had been introduced into Malta from India that year, and appeared hard and wonderfully prolific. Yet it failed in 1855.

The author of these observations had, however, previously distributed its eggs throughout Italy, France, and Algeria, and, continuing to watch the trials made in these countries, he found that the new silkworm had flourished and had been carried into Spain and Portugal.

He therefore reintroduced it into Malta. At the end of July 1857 he received a few eggs by post in a quill from Paris, and these multiplied in an extraordinary manner. The winter season (December) appeared to affect the caterpillars even in Malta where they grew slower but nevertheless appeared to be healthy. Considering the dearth of practical, and profitable industries in the islands this subject might well engage the attention the Malta Society of Arts and Industries.

Mantidae

When we hear the word "locust" we immediately think of devastated fields, famine, and despairing human beings, and we also remember what we were taught during our first years at school about Moses, Pharaoh, and the seven plagues. But we are unjust when we class all the genera of orthopter

together, as they are not all "vegetarians" to be dreaded by the farmer and gardener. We must divide them into two groups, the jumpers and the walkers. The members of the former group, to which the ill-famed migratory locusts and the common green grasshopper belong, live on plants, although they do not scorn an occasional fat caterpillar; and they are quick in their movements, flying and jumping, for their long legs permit this latter movement. The males make a peculiar whirring or chirping sound. Those of the second group, which includes the praying mantis and the specter or walking stick, are not musical. They move deliberately, fly little or are entirely incapable of flying, and live exclusively on insects or exclusively on plants. The mantis is one of the insect eaters.

The mantidae are voracious creatures of prey, and like all of this character, live alone. They are the oddest of insects. Their wings lie close, the posterior wings overlapping slightly instead of meeting like the parts of a roof, as do those of the grasshopper; the foremost breast wing is lengthened considerably and carries the little head with its great eyes and short feelers; but their fore legs constitute their most noteworthy feature. There is nothing peculiar about the two other pairs of legs, they are simply rather slender limbs which permit a slow movement; but the fore legs, which are never used in going from place to place, are so constructed as to serve as formidable weapons. The hip portions are unusually long, and the thighs pressed together sidewise and furrowed lengthwise underneath. The sharp edged second joint fits into this furrow, that is provided on the edges with pointed pricklers, as the blade fits into the handle of a pocket knife. These legs are their graspers, and the only creature that has anything similar is the lobster. The mantis does not touch these legs to the ground, but holds them closed in such an amusing attitude that he has received a list of undeserved names from the people; such as; Gottesanbeterin in German, Louvadios in Portuguese, Preque dicu or Precheur in French dialect, and in English praying mantis or soothsayer. All of these names indicate a misunderstanding of the object with which the creature holds its fore legs folded and raised; it would seem as if it were praying, but, in reality, this is only the mean mask of

Tartuffe, or the artifice of the robber. I have only had opportunity to observe in Trieste the common green mantis (*Mantis religiosa* L.), which now reaches its northern limit near Vienna or Brunn, and in the neighborhood of Freiburg in Breisgau, but in the last century was found, according to Leyding, near Wurzburg and Frankfort a. M. All communications received in regard to the habits of those that live in the temperate and tropical countries of both hemispheres, however, agree with my observations. The creature sits, the only movement being in the head, which it turns back and forth as it looks on all sides. These motions would seem very strange to a naturalist who had only observed other insects. Now one of the flies which I put in the glass for the mantis approaches it and settles on its green wing, which, to the fly, does not look different in any way from a leaf. The expectancy of the spectator and of the hungry mantis increases; the victim crawls heedlessly forward, now it comes within reach of the graspers, the knife opens and snaps together, the struggling, confiding fly is caught and soon every particle of it has disappeared. The mantis assumes its former attitude and waits, greedy fellow that he is, for a new victim.

It is stated on good authority that the tropical species will overpower and eat lizards three times as long as themselves, and even small birds are surprised while sleeping and devoured. The little *Mantis religiosa* of Southern Europe, although less than three inches long, will defend itself against man, and the gigantic species of hot countries cause bloody wounds in the human skin with their saber-like legs. But the worst characteristic of the mantis is the amazon-like trait which it shares only with some spiders. The female mantis is larger and stronger than the male, and she murders her mate in cold blood, when she can get him, and eats the father of her future children without the least compunction. The creatures are always quarrelsome among themselves, the stronger kills the weaker, and brothers and sisters wage war against one another from the first.

A creature of prey which is capable of only a slow movement, and cannot capture its victims by rapidity of pursuit or suddenness of attack, must have some other means of taking them by surprise and such a means is invisibility. Let me be rightly

understood. I mean relative, not absolute invisibility, which the mantis obtains by the coloring and form of its body, more especially of its fore wings, which are of such a nature that the creature does not seem to stand out from the ground on which it awaits its prey and is not distinguishable from the leaves and other parts of plants. Some are bright green, like the *Mantis religiosa* of Europe, so that they resemble fresh leaves; others are yellow, like faded foliage; and still others are a brown or leather color, with dark spots and glassy, transparent places on the fore wings, so that they look like an old weatherbeaten leaf to which fungi have attached themselves, and parts of the epidermis of which have been removed by insects and influence of the weather, so that its ribs and nerves resemble the veins of the mantis wings.

Scientists who have explored tropical countries and other travelers that understand nature—there are, unfortunately, few of the latter—agree that the mantis is wonderfully protected by its resemblance to foliage. This fact has not escaped the notice of the masses in those hot countries and has given rise to all kinds of superstitions. The noted printer, Marie Sibylle Merian, of Frankfort a. M., who remained in tropical South America specially to paint insects and flowers, says that in Surinam it is supposed that the creature grows, as leaves do, on trees, falls off after a time, and then flies or crawls away. A superstition which is just the opposite of this is related by Wilhelm Piso (1658) in his "Naturgeschichte Brasiliens" (Natural History of Brazil). He says the creature changes to a plant: fixing its feet in the ground, roots are caused to grow by the influence of moisture.

The species named *Idolum diabolicum*, is a native of the interior of Africa. Its most remarkable features are the sidewise widening of the thorax, which is sharp edged, and of the abdomen. The lower ends of the second joints of the legs are also broadened out in leaf shape. A glance at the fore feet with their armature of spines will show us what terrible weapons they must be. The helmet-shaped projection on the head is peculiar to several tropical species.

*Translated by the "Scientific American" from
"Illustrirte Zeitung."*

An Under Valued Product.

The origin of maize or Indian corn, is unknown, but it was first cultivated by white men on the James River, Virginia, in 1608. It is, says Mr. C. J. Murphy, about the only product of America that is not appreciated in Europe. American wheat, cotton, fruits and meats are now well known in the world's markets, but maize is still shunned for use in the human dietary of the British Isles and most of the Continent. Yet analysis proves that the nutritive value of maize cannot be less than five-sixths of that of wheat. This food is, moreover, of remarkable healthfulness, and dyspepsia was scarcely known in America fifty years ago, when maize was the principal food. A surprising number of delicacies and inexpensive dishes is now supplied, not less than 130 recipes for boiling, baking and cooking this great staple having been tested and approved. The annual surplus of maize in the United States is enormous. It is used for feeding cattle and hogs, in making glucose, starch, beer and whiskey, and recently, for producing oil. No part of the plant is lost. The fodder is valuable food for animals, and has been used as fuel in treeless parts of the West, while the husks are made into paper, or employed for filling mattresses, packing fruits, and wrapping cigars.

Insects in Biscuit.

BY SURGEON CAPTAIN HUGHES A.M.S.

As I have during the last year been investigating the life history of the insects infesting some hundreds of cases of biscuits, shipped from England, I bring forward the following facts in case they may be useful to others.

The biscuit in question was packed in England and sent out in tins supposed to be hermetically sealed, these tins being again enclosed in outer wooden cases. A large percentage of the tins were however, found to leak at the corners or seams, and in a few instances the nails used in closing the outer wooden cases had penetrated the tins.

The following classes of insects were found:—

I. The common weevil (*Calandra granana*), a

small red beetle about the same size, and two small scorpions. The last were in tins with large leaks and must have gained entrance in Malta. The two former were very numerous in the biscuit store, coming from the adjacent forrage and wheat stores. They were found on the walls of the store, between the wooden and tin cases and within such cases only as possessed holes large enough for them to enter by. On this account there could be little doubt that they gained access to the tins from the store in Malta. These insects pulverise the biscuit to some extent but do little other damage.

II. The larvae and imago of a larger beetle kindly forwarded by Surgeon Major Manchè R.M.A. to Dr. Caruana Gatto, who identified it as the *Tenebroides Mauritanicus* (fam. Nitidulidae, Coloptera). This beetle is rather less than $\frac{1}{2}$ inch long and is common to Malta, Gibraltar, Burmah &c. It lays its eggs on the biscuit and there develops, eating out a chamber in the centre. When full grown they are white in colour $\frac{1}{2}$ to $\frac{3}{4}$ inch long, with a brown head, and flat, broad, segmented body. At this period they migrate if possible to some convenient spot and there undergo the change from larvae to beetles. Their cycle of existence would appear to be one year, six to eight months being taken up in the change from larvae to beetle. These biscuits were received from England early in 1890 and in December 1891 they were found to contain full sized larvae, which in turn became beetles in August and September 1892, in captivity in an artificial incubator. Full grown beetles were only found in tins having holes large enough for them to find entrance while larvae were found in many tins, all of which possessed small leakage holes. Neither larvae or beetles were found in hermetically sealed tins. The beetle is very common in Malta, and was found in two cases between the wooden and tin cases. From the above facts we concluded that the biscuit became infected in Malta probably in August 1891, though it is possible that those cases with large nail holes, containing beetles became infected the year before. As a preventive measure all biscuit is in future to be stored well away from forrage and wheat stores and the present emptied tins after being treated with condy's fluid, were refilled with Navy biscuit while warm from the oven and afterward really hermetically sealed.

III. The last insect was the chocolate moth (*Ephestia elutella*) a small dark grey moth the females of which when present fly about in swarms at night and lay their eggs on the biscuit. The larvae are about $\frac{1}{2}$ inch long, narrow and pink in colour. They are soon hatched and by means of their strong jaws and active legs scrape and bore their way through crevices to the centre of the biscuit. Here, when full grown, they undergo the pupal state and spoil the biscuits completely by their excreta and the way in which they bind the biscuits together with webs. A single square biscuit may contain some six or eight pupae. The moth first appears in June and breeds fast until September, when the remaining pupae hibernate until the following year. They are common in the cocoa stores of Cork and Gibraltar where they are a frightful scourge, but I have seen none about the stores in Malta.

The tins containing them were at once placed in the furnace and destroyed, a few specimens being kept under observation in the incubator. But few tins were so affected and these showed no means by which the moth could have gained entrance. From the fact that the biscuits were matted together with web and contained dead moths and live hibernating pupae in great numbers it was evident in December 1890 and January 1892 that previous broods had existed in these tins and and it was probable that the tins were infected before leaving England.

Professor Huxley who reported to a special commission on this subject gives the following advice:—

- (1) To have no cocoa stored in any place in which biscuits are manufactured.
- (2) To head up all biscuit puncheons as soon as they are full of the freshly baked biscuit.
- (3) Coat puncheons with tar as soon as they are headed up, or at least work lime wash well into all the joints and crevices.
- (4) Line the bead-rooms of ships with tin, so that if the ephestia has got into a puncheon it may not get into the rest of the ship.
- (5) If other means fail, expose woodwork of puncheons to a heat of 200 F for two hours.

Armenia

By PROFESSOR MINASSE TCHERAZ.

The historical limits of Armenia are very elastic. Its sovereigns, when they were not urged on by the thirst for conquest, remained generally satisfied with ruling the fifteen provinces of Greater Armenia; but some bellicose kings, among whom a few even took the ambitious title of *King of Kings*, widened these boundaries in all directions. Moses of Khoren, the Herodotus of Armenia, says, without circumlocution: "The brave have no other limits than their weapons, which acquire as much as they cut off." Thus, then, in its periods of splendour, Armenia has generally been bounded by the Caucasus mountains, the Black Sea, the Caspian, the plains of Mesopotamia, and the banks of the Euphrates. From this vast volcanic plateau, the height of which varies between 2,700 and 11,000 feet, rise numerous watercourses, the most celebrated of which are the Euphrates, Tigris, Dj-rokh (Phasis or Phison) and the Araxes (Gehon). These rivers, according to the Bible, came out of the terrestrial Paradise, a statement which gave rise to the tradition which places the cradle of the human race in Armenia. The mountain system of the country, enriched by the mighty offshoots from the Caucasus and Taurus, gives it an imposing aspect, and the Koords owe their wild customs to the inaccessible height of the Gortok chain, where their tents have been pitched from the remotest antiquity. What, however, constitutes the glory of this island of mountains, as Ritter called Armenia, is the majestic Ararat, which rises to a height of 17,212 feet, 1,431 feet higher than the most elevated mountain in Europe, Mont Blanc, and is, according to Olearius, used by the sailors of the Caspian Sea as a sort of polar star. Professor James Bryce, who ascended Mount Ararat in 1876, gives, in his "Transcaucasia and Ararat," a fine description of this classic mountain, where Eastern tradition and the Bible make Noah's ark rest. I visited Russian Armenia in 1888, and the monks of the celebrated monastery of Etchmiadzin, near Mount Ararat, showed me a fragment of the ark. I am not prepared to guarantee its genuineness. All I can say is that this piece of wreck appeared to be of very old and very solid wood, more solid, perhaps, than the legend con-

nected with it. Armenia is, moreover, embellished by a number of lakes, among which the most noticeable are Lake Sevan, with an islet containing three monasteries in Armenian style; Lake Urumiyah, in Persian Armenia; and especially Lake Van, which receives the waters of some forty streams, and nourishes an immense number of herrings, a true manna for the people of the shore. With regard to climate and produce, Armenia is a kind of microcosm. Generally speaking, the northern portion recalls the arctic zone, the central portion assumes the aspect of the temperate zone, and the part which borders on Mesopotamia is as warm as a country situated in the torrid zone. Its produce is also similar. The valleys are extremely fertile, and present a very rich flora, all kinds of grains and cereals, rice, cotton, hemp, flax, gall-nuts, madder, tobacco, and delicious fruit, including the apricot, the *prunus Armeniaca* of the Romans. On the hills grow magnificent grapes, from which is obtained an excellent wine, the direct descendant of that wine which affected the head of our good Patriarch Noah. The mountains are not much wooded, but covered with luxuriant pastures, suitable for the breeding of cattle and the rearing of horses. The prophet Ezekiel tells us that the Syrians received their horses from Armenia, in the same way as the Hebrews for a long time obtained their mules from that country. Xenophon relates that this country supplied a contingent of 4,000 horse to the King of Assyria at the time of his war with the sovereign of the Medes. According to Appian, when Mithridates went to take refuge with Tigranes the Great, King of Armenia, the latter at once levied 50,000 horse as well as 200,000 foot soldiers, and afterwards 35,000 horse with 70,000 foot. Hammer quotes the fact that Hethoum, King of Armenian Cilicia, provided a contingent of 12,000 horse with 40,000 foot to his Tartar ally, Hulagu, at the time of the latter's expedition against Persia. These few figures bear testimony to a great abundance of horses in ancient and mediæval times, a source of wealth which a wise administration could restore to the countries whose natives formerly taught the Romans some novel ideas in the art of breeding horses. What is especially abundant in Armenia is bread and meat. The corn is of a supe-

rior quality, and it was from Armenia that the Romans received their provision of salt meat. "At the present day still," writes M. de Tchihatchef in his "Bosphorus and Constantinople," "the salt meat of a Kaisaria and Angora is celebrated in the peninsula under the name of *pasterma*. It chiefly consists of mutton, which is of a splendid quality, and probably superior to all the beef produced by Europe and the United States of America." Van has its delicate white honey, and Moush its sweet manna which the peasant women gather from the leaves of the trees. The ancient province of Vasbouragan is still rich in *ermine*, an alteration of *Armenia*, the name of the country from which the fur of this animal was originally obtained, and especially in the so called Angora cats and goats. The cochineal is met with at the foot of Mount Ararat, and everywhere are mines of copper, iron, lead, silver, sulphur, arsenic, coal, even of gold, as rich as they are untouched while the quarries are lined with marble and jasper, and the rock-salt, alum, naphta, and the famous Armenian bole are only waitin on the surface for any one who will take the trouble to pick them up. Here, then, is a country not so very far from Cyprus, where some of those Englishmen ought to emigrate who place the immensity of the seas between them and their mother country. By transferring their money and energy to Armenia, the sons of Great Britain would only have to choose among the thousand-and-one branches which commend themselves to their activity in a country where, as yet, scarcely a single factory chimney smokes, nor has a single railroad been opened by the fatalist government of the Turks, Persians, and even Russians, who have partitioned this Asiatic Poland.

The Relationship of the Structure of Rocks to the conditions of their Formation.

BY H. J. JOHNSTON LAVIS, M.D., F.G.S.,

For the present, however, we may state the divisions as follow:—

1. Ejection of vitreous froth, which rapidly solidifies, as pumice; all the minerals that occur crystallized are of plutonic separation, as sanidine, biotite, amphibole, &c.

2. Microcrystalline pumice, in which surface cooling has produced pyroxene and leucite. The amount of vitreous base diminishes as we reach the top of this division, and is replaced by *formed* material.

3. The pumiceous ash-bed in which the cementing vitreous base is nearly all destroyed, so that cohesion has become so feeble that the formed matter separates, producing an *ash* composed of crystals and microliths. The difference is very similar to the results of crystallization of a salt in the form of large crystals by a slow process, or, in the preparation of the granular state, by a quick one, as table salt, pure Ferrous sulphate, and oxalic acid, as they are met with in commerce.

The increase of the percentage of silica has the effect of rendering acid-rocks less easily crystallizable, just as the amorphous form of sugar retards crystallization of other bodies with which it is mixed. For the same cause, the viscosity of the rock is increased, so that the escape of the enclosed gaseous bubbles takes place with greater difficulty; and, as a result, the pumiceous character is far more common amongst such rocks.

Mode of Formation and Structure of Scoria.—This product, which is often erroneously grouped together with pumice, is that spongy variety of lava which covers or underlies a stream. When the magma does not contain sufficient volatile constituents to tear it asunder before it issues from the volcanic vent, it will pour down the slopes of the cone, giving up what remnants of aqueous matter are still dissolved within it. Should this be considerable in amount, and the temperature of the lava rather low, in basic examples we shall get an irregular broken-up cinder-like mass, that will continue to float on the surface, and cover it in some cases to a great thickness. Prof. Judd, who fully appreciates this fact, gives a striking example of this side by side with an equally interesting illustration of the opposite condition. On the contrary, should a basic magma be remarkably devoid of dissolved water, its surface will not be broken up, and it will assume forms like any other viscid body in movement. In the case of a water-bearing acid lava, the scoria surface will be much thicker, on account of the difficulty with which the gaseous materials escape in consequence of the viscosity of the paste; whilst in nearly nonaqui-

ferous acid lavas the surface figures that result will be more marked, and more characteristic of an intensely viscous magma, as illustrated in the mammelon volcanoes, such as the islands of Reunion, Hawaii, the obsidian stream of Vulcano, or some of the central French groups. On the other hand, the Vesuvian lavas of 1858 and 1872, as pointed out by Judd, are respectively typical of aquiferous and non-aquiferous magmas, which may be further illustrated by the trachyte of Monte Olibano, and the Lava del Arso of Ischia.

From the mode of formation of scoria we must expect it to exhibit two very marked differences in structure and mineral composition from pumice. In the latter the vesicular cavities are of all sizes, ranging down to the minutest dimensions, which are the most abundant and marked characteristic of pumice. This is due to the intermolecular separation of steam and its union *sopra loco* into vesicles of varying dimensions. In the case of the scoria, the gases are derived from the whole thickness of the subjacent lava, which, in rising in the mass, further unite together, so that the cavities are rarely of microscopic size, and may reach very great dimensions; and unless the bubbles be of a certain size, the large area of their surface in proportion to their volume increases, so that the friction is so much that they could not rise in the viscid mass. In the case of pumice we have the vesicular structure developing in a complete or nearly vitreous magma, which is the principal cause of rapid solidification; but in scoria the bubbles of hot gas that rise from the bottom, which, from being more protected, is the hottest part, through a magma already far advanced in crystallization, would help to prevent or ward off the cooling of the surface. Besides, the scoria will cool slowly, resting as it does on the surface of a highly-heated mass. We therefore may sum up by stating that pumice is filled by vesicles of all sizes, but mostly small, and approaches the vitreous state, whilst scoria only contains vesicles of large size, and approaches a crystalline structure. The ejectamenta during strombolian action is a true scoria, being dependent upon borrowed steam that rises in the magma column, and forms the vesicles.

In lavas the presence of vesicular cavities is no proof of the actual amount of original vapour, for the latter will be allowed to more easily escape in

a microcrystalline mass, such as that of 1631 of Vesuvius, which is a very compact rock, yet gave forth enormous quantities of vapour as almost to resemble the explosive type of eruption. The lava of 1858, which is rich in large leucite crystals and much interstitial glass, is a remarkable spongy structure, because its viscid nature prevented the escape of the few included bubbles of vapour, which, compared with others, was remarkably small in quantity in that eruption, affording compact types of lava surface. This escape of vapour may so separate the constituent minerals of a scoria surface as to leave it in a perfectly incoherent and pulverulent state. This I have seen in some of the trachytes of Ischia, and of the Solfatara (Monte Olibano).

Another fact is, that lava as it pours out, that portion which is nearer the surface will, in all probability, be the richest in water, and will produce a stream thickly covered with scoria. But as the portion which comes from greater depths rises it will have been exposed for less time to aquiferous rocks, and in consequence, containing less water, will produce a smoother-surfaced steam. This was remarkably the case in the Vesuvian eruption of 1855;¹ the first streams that issued were much rougher than those at a later date.

The conditions under which the composition of Igneous Rocks is modified.—One of the most vexed questions in geology is undoubtedly that of the variation in an igneous rock, and more especially with regard to its chemical than its mineral composition. Space forbids here to enter fully into the theory of stratification of magmas, as represented by Von Richthofen and others. No distinct division can be drawn between rocks derived from the most acid, and the ultrabasic magmas, showing that they can mix in all proportion. Then again, whatever be the silicates we may fuse together, none of them separate from each other, however long they may be kept in the fluid state. Thirdly, all magmas may be looked upon as originally mixtures of fused oxides, some basic and other acid, it is true; but in either extreme types there is a certain amount of intermixture. We find such substances as the fast, mineral oils, chlo-

roform separating from water, or mercury from either; but we must remember that these incompatibles are built up of molecules, arranged on entirely different plans, which is not the case with the constituents of volcanic rocks. It may seem improbable, but I feel sure that time will show that the active cause of various rock composition, at any rate, to a certain extent, will be proved to result from some chemical changes brought about between an isolated portion of an original common magma and the neighbouring rocks. Also the infiltration of saline solutions may result in the bases of the contained salts, combining with the silica, and liberating the original acids. The facts that support such a theory are certainly few, but also those that can be urged against it are equally so, and in most cases can be answered. Thus, for instance, when great dykes, such as those that traverse the north of England for miles, change little their composition; and we hear, even at a most recent date, such an authority as Mr. Teall arguing against this theory; it does seem in a tottering state. We must, however, remember that in most cases we are only able to examine a dyke, over any large area, in its horizontal extension; but what is really necessary would be to investigate such sheets of rock in their vertical extension. There are examples in various parts of the world where dykes that extend to some distance show alteration in composition as the rocks traversed change in character.² Von Buch and others have shown that in the Tyrol granite veins gradually pass into basalt ones, when traversing dolomitic limestone. The basalts of the Cyclopean Islands that are intrusive in a clay are most markedly altered where the dykes are thinnest. It has been shown that the great Whin-Sill has swallowed up beds roughly equal to its own thickness. On theoretical grounds we could easily understand an acid lava taking up limestone with its impurities, and becoming more basic, and thus reducing its temperature whilst it became more fluid. If this were the case we can understand that further action on limestone would be limited by saturation of the

(1) *Memoria S. Lucend. Vesuvio*, 1855, G. Guarrini, L. Palmieri, and A. Scacchi.

(2) N. S. Shaler. "Propositions concerning the classification of Lavas considered with reference to the circumstances of their extrusion." *Anniversary Memoirs of the Boston Society of Natural History*, 1880.

magma with lime and its low temperature. It therefore seems that we should look more to granite and its derivative as fuses of limestones than to basic rocks. Why should not the basalts of Mull be the result of the contact of the granites with the underlying limestones? I have brought the subject forward, not with the intention of offering new evidence, but to again direct attention to such an important branch of vulcanological science.

(to be continued)

Albinism and colour variation in Maltese wild flowers.

BY DR. ALFRED CARUANA GATTO.

In noting all the albinos and colour variations I happened to meet with in our indigenous plants I do not intend to give simply a list of them, but I wish rather to point out in what way such varieties take place in plants such as our wild ones, when not subject to any artificial treatment like cultivation and when they are left to themselves under nature's direct agencies.

I have not analyzed and I believe I could not, even if I would, the various causes which led to them, and which I expect, are here just as any where else, the composition of the soil, light, temperature and crossing; and my notes referring to such a circumscribed area as that of our Island have therefore no claim to stand good but with reference to our flora—they may however always be of some use for comparison with other floras.

The occurrence of albinisms and colour-variations in certain groups in preference to others and their relative frequency in such cases have led me to observe that few species are subject to hereditary and constant variation, and that the greater part are occasional variations due to individual causes and which though they perhaps repeat themselves each year in the same species are not transmitted by heredity, which fact in case of albinisms does not astonish me, because considering that they are generally due to a lack or diminution of constructive faculty or at least that they are considered more as degenerated forms than as

improved ones as it follows that this character, is little adapted for generative transmission.

Of the constant colour variation the most remarkable is that of the yellow *Adonis microcarpa* D.C., which in its typical form is of a bright red. This variety called by Gussone *citrina* is rarely found in rich soil and shows a beginning of degeneration in the floral envelope by the very frequent want of one or two petals, sometimes of all the petals which are scarcely developed. Bulbous monocotyledons afford us also some hereditary albinisms, and we have thus *Scilla sicula* var. *candida* Guss., considered by some authors as a distinct species, but which nevertheless is nothing else but an albino of the normal *Sc. sicula*, of which the flowers are of a lilac of various shades. All our *Orchis* offer also more or less such a phenomenon, especially *Anacamptis pyramidalis* Rich. which has two forms, one with rose or pale rose flowers flowering in March, April, the other with flowers of a deep purple which flowers in April, May:—The first form has often its flowers of a perfect white.

What is to be noted next is the greater liability to albinism of flowers belonging to the cyanic series than those which fall under the xanthic series, and that, in that series the colours which most easily fade into white are the purple and the lilac which are easily affected by the slightest causes. If it would be ascertained that this is not only the case with our flora but a general occurrence in albinisms it would be explained by the fact mentioned by Prof. Henslow in the Gardener's Chronicle p. 125—Aug. 3, 1889, that in the evolution of colours in flowers, the xanthic series comes before the cyanic one, and that plants which have reached the higher stages in this evolution revert more readily to the more primitive colours than do those of which the colours have much greater stability, what is confirmed by Dr. Sorby's assertion that of all colours yellow xanthophyll is the most stable under sunlight. We have therefore Labiates, Scrophulariaceae and Valerianaceae amongst the families which give the greater number of albinism, whilst Hypericinae and families which contain many plants with yellow flowers give comparatively but few instances if any.

The albinisms I have noted amongst our wild flowers are the following.

FROM BLUE FLOWERS.

Anemone coronaria L.
Anagallis coerulea
 Schreb
Borago officinalis L.
Achusa italica Retz
Echium calycinum
 Viv.
Salvia clandestina L.
Vitex agnus castus L.
Romulea ramiflora Ten

FROM RED FLOWERS.

Adonis microcarpa D.C.
Papaver dubium L.

FROM YELLOW
FLOWERS.

Ranunculus bullatus L.
Brassica campestris L.
Chrysanthemum coronarium L.

FROM PURPLE, ROSE,
OR LILAC FLOWERS.

Papaver setigerum D.C.
Enarthrocarpus pterocarpus Pers.
Cakile maritima Scop.
Matthiola incana Br.
Frankenia hirsuta L.
 " *pulverulenta* L.
Silene bipartita Desf.
Spergularia rubra Pers.
Malva sylvestris L.
 " *nicaensis* L.
 " *parviflora* L.
Geranium molle L.
 " *Robertianum* L.
Erodium cicutarium
 L'Her.
 " *moschatum*
 L'Her.
Hedysarum coronarium
 L.
 " *capitatum* Desf.
Trifolium resupinatum
 L.
Vicia sativa L.
Rubus fruticosus L.
Epilobium tetragonum
 L.
Asperula longiflora W.
 K.
Centranthus calcitrapa
 DuRr.
Fedia cornucopia G.
Scabiosa maritima L.
Carduus pycnocephalus
 L.
Erica multiflora L.
Anthirrium majus L.
Rosmarinus officinalis
 L.
Lamium amplexicaule
 L.
Mentha pulegium L.
Orchis saccata Ten
 " *lactea* Pocr
Anacamptis pyramidalis Rich.
Gladiolus segetum Ten
Scilla sicula Ten
Colchicum Bertolonii
 Stev.

white, but that sometimes the decolorating causes are not enough to turn into white the blue colour, and hence the rose appearance of the flower.

In both *Adonis* and *Papaver* I have also met with intermediate forms with orange flowers, whilst many of the corollas of flowers of the purplish series like *Matthiola*, *Anthirrium*, *Papaver*, exactly as under cultivation, presented themselves streaked, sometimes with a predominance, of their original colour, some other with variegations on a white ground.

It might be as well noted that in all the colour variations I have seen I have not met with any aberration in the ascending order of colours, but the change has always been from blue to rose or to white, from purple or red to white, but never from white to rose or yellow or blue, or from rose to blue. The only exceptions I know of among our flowers are the *var. rubiflora* Guss of *Vulneraria heterophylla* and the occasional deeper shade of some purple or purplish corollas such as *Erica*, *Rubus*, *Lathyrus*, *Silene* ecc. which calls to our mind again that purple as a colour of transition is one that offers great unstableness.

Exploration of the Black Sea.

In a communication to the Odessa Society of Naturalists, published in its 'Memoirs' (vol. xvi; fasc- 2), Dr. Ostroumoff gives a preliminary report on the fauna of the Black Sea, based on the explorations which were carried on last summer on board the war-sloops *Donets* and *Zaporozjets*, and the schooner *Kazbek*. The researches of the expedition confirm the hypothesis of Edward Forbes, according to which the Black Sea was formerly a part of a wide brackish Aral-Caspian basin, which became connected at a recent epoch with the Mediterranean. The salt-water Mediterranean species must have penetrated into the Black Sea since that time, spreading from the west, and compelling the previous fresh-water and brackish-water inhabitants of the sea to retreat to the mouths of the rivers. The explorations also confirmed the remarkable fact of the total absence of animal life at depths exceeding 100 fathoms. Samples of mud from greater depths, when examined under the microscope, proved to contain no traces whatever of living organisms. They only

Now in some cases I have seen on the same plant or on different specimens the gradual fading of the normal colour into white, and generally I have seen that all blue flowers before attaining the white colour pass first into purple or rose; not that the same flower first becomes rose and then

contained skeletons or parts of dead organisms. The mud of great depths is usually covered with a deposit of carbonate of lime, and sometimes with a black crust of sulphide of iron. A deposit of red iron oxide is frequently found upon the mud and shells brought up from less depths. In May the upper zone of the water, in which life exists, may be roughly divided into three layers. In the superficial layer down to 25 fathoms, the temperature (46° to $44^{\circ}.6$), which extends from 25 to 40 fathoms, and in the lower layer down to 100 fathoms the temperature slowly rises from 46° to 48° F. The last-mentioned layer was characterised by the abundance of full-sized Copepods the middle one, by its richness in *Sagitta*, while the lower parts of the upper layer contained numbers of Ctenophores (*Horniphora*, *Pleurobrachia*), Appendiculariæ, and the medusa *Aurelia aurita*. The lower limits of organic life are determined by the abundance of sulphuretted hydrogen in the configuration of the bottom. A characteristic representative of the fauna of the greater depths (70 to 90 fathoms) is the little Crustacean *Apseudes* (the species is named *cæcus* by the author), which lost its eyes, and has instead two slightly translucent buttons. The Mediterranean Holothurian, which was discovered last year by Mr. Andrusoff, opposite the Bosphorus, undoubtedly is an immigrant from the west. It is also quite common along the Anatolian coast at depths below 50 fathoms, and it has been found twice (70 fathoms) off the south coast of the Crimea. In its migrations in the Black Sea, it must have derived an advantage from its easy accommodation to life in less salt water. The south-western part of the Black Sea, off the Bosphorus, is rich with species which have immigrated from the west. The preliminary results of the chemical analyses of water at different depths, which are published in the same volume, by the chemist of the expedition, A. Lebedintseff, are also very interesting, although a considerable time will yet be required to complete the analyses. As the result of analyses at fifty-seven stations, one litre of water (at normal temperature and pressure) was found to contain gaseous sulphuretted hydrogen in solution in the proportion of 0.33 cubic centimetres at 100 fathoms, increasing to 2.22 cubic centimetres at 200 fathoms, and no less than 6.55 cubic centimetres at the

bottom. The salinity of the water was determined by the chemical method at 140 different stations. It appears that the water of the Sea of Azov contains, as a rule, only one-half the amount of combined chlorine found in the superficial layers of the Black Sea, namely, from 5.32 to 6.02 grammes per litre of water, and that this amount varies very little with the increase of depth. In the Black Sea the amount of chlorine varies, in the superficial layers, from 7.6 grammes off the Danube to about 10 grammes elsewhere. At a spot where the lower current of salt Mediterranean water is supposed to flow in from the Bosphorus, the amount of chlorine was 9.81 grammes per litre. The salinity increased gradually to 11.65 at 30 fathoms, and then abruptly to 19.30 at 40 fathoms, where the water was as salt that of the ocean. The amount of organic matters contained in the water also increases with increasing depth. From the geographical point of view such preliminary conclusions as may be drawn are of value, because they show how closely physical researches bear on the origin of the existing distribution of land and water. They throw light on that border-land which the geologist cannot enter from his side, and to which the historical geographer cannot reach back from ours. In this scarcely-touched department of synthetic research it is not too much to hope that the origin of many of the events of history may ultimately be found.

Journ. R. G. S.

On the Vine and Potato Disease in Malta.

In no country have the efforts of the agriculturist to combat the virulent diseases of the potato and the vine been carried out with more vigour and persistency, and been attended with more complete success than in France.

The mildews *Oidium* and *Peronospera* that have attacked the French vines, have been, as our readers are already aware from the recently published report of the Malta Vine commission, in the Malta vineyards for some time past. A few remarks therefore upon the results of the recent experiments that have been carried out by the French savants may be both interesting and instructive to

a large section. In the course of a report presented to the agricultural Society Mr. C. Whitehead F.G.S., says that constant applications of powdered sulphur keep the *Oidium* in subjection in ordinary climatic conditions if they are made regularly at certain defined intervals, but that sulphur has no effect, or comparatively no effect, upon the *Peronospora viticola*. Sulphate of Copper is employed with wonderful results against the latter fungus. In France, he tells us, it was the custom to sprinkle the grapes by the roadside with dust mixed with verdigris to choke off marauders; after a time Sulphate of Copper being cheaper was used for the purpose. When the *Peronospora viticola* appeared in France in 1878, it was remarked that its effect upon the vines thus treated was modified, also that the leaves kept normally green. This led to the trial of sulphate of copper as a remedy, which owing mainly to the energy of M. M. Prilleux, Millardet, and Gayon, has been found to be completely satisfactory. In 1886 M. M. Prilleux reported to the Société Nationale d'Agriculture de France that "the numerous experiments made this year have demonstrated beyond a doubt the efficacy of salts of copper in combating *Peronospora*."

But it was not for the Vines only that its utility was proved. In a series of experiments carried out by M. Aimé Girard in 1888, 1889, 1890, 1891 it was shown that sulphate of copper is as effective against the potato mildew (*Phytophthora infestans*), which has of late years proved itself to be such a curse to the potato growers of these islands, as it is against the vine mildew. Experiments were also carried out at the expense of Government in Belgium, the results of which were similar in every respect.

In America too, trials were made in 1889 with remarkable success, and at Cape Town the agricultural journal informs us that "several experts have tried solutions of blue vitrol with good results on enfeebled crops."

M. M. Millardet, Gayon, and Schlesing have shown that the *conidia* (the minute spores) of the vine mildew cannot germinate in water containing the most infinitesimal quantity of sulphate of copper. This was proved in the following manner. The *conidia* of the fungus sown upon leaves that had been treated with weak sulphate of copper

solution did not germinate, while *conidia* sown upon leaves untreated with sulphate germinated perfectly in rain drops upon their upper surfaces. It was found that vine leaves untreated with sulphate of copper resisted inoculation by the fungus when *conidia* were sown on their under sides where the disease first manifests itself. The potato disease first appears upon the under side of the leaves and afterwards descends to the tubers. Spraying of the plants with a weak solution of salts of copper would prevent the establishment of the disease, and would at the same time considerably increase the crop.

The Board of the Royal Agricultural Society of Great Britain are convinced that this is a sure preventive of the potato disease, and that if adopted in the earlier stages it will act as a cure for it.

Considering the great losses that are annually experienced by the potato growers in these islands, it would most probably pay them to give this matter their serious consideration.

J. H. C.

A year's Insect-hunting at Gibraltar.

BY JAMES J. WALKER, R.N., F.E.S.

IV.

(conclusion)

In June, my first noteworthy capture was the beautiful little *Aurotis roboris*, E., flying about an oak tree in the Cork Woods on the 4th, but it appeared to be rare, and I got only one more, on the 9th. *Vanessa polychloros* L., and *Gonepteryx rhamni*, L. (of both of which I had seen hibernated examples in the spring), were also taken on the 9th and two pretty "Burnets," *Zygena staechadis*, Bork., and *Sarpedon Hübn.*, were found, but were scarce and local. *Catocala paranympa*, L., was not scarce on the cork trunks, and the little chestnut-brown *Anthometra plumularia*, Bdv., was often seen flying over broom bushes. Two "clear-wings," *Sesia Ramburi*, Staud., and *Paranthrene tineiformis*, E., occurred on the flowers of wild carrot and and thyme, which were also frequented by *Acontia luctuosa*, W. V., and *Acidalia ornata*, Scop. On the 18th I took, at Campamento, the only specimen of *Argynnis Latona*, E., which I have seen in the district, and, on the same day, *Catias Edusa*, var. *Helice*, Hb., was common and fine, among myriads

of the ordinary form. On the 20th I saw for the first time on the Rock the conspicuous *Satyrus Fidia*, L.,* and a week later it was common. It is a very imposing looking butterfly on the wing, but flies strongly, and has a *penchant* for the roughest and most tangled spots, occasionally settling on rocks or walls, but is very shy and difficult to approach, being more easily taken in the afternoon, when it comes down to the newly watered roads. I took *Thecla spini* on the Rock on the 22nd, and on the 26th, *Cænonympha Dorus*, E., was met with near San Roque. Second broods of *Leucophasia sinapis*, *Pyrgus Proto* and *Sao*, occurred this month, the last being much more common and widely distributed than the first brood had been. *Coleoptera*, although still very numerous in individuals, fell off greatly in number of species towards the end of the month, my chief additional captures being the bulky *Polyphylla fullo*, L., on the Rock *Lagria lata*, F., *Trichius abdominalis*, Ménétr., and three species of *Cebrio*, unfortunately all singly; *Calosoma sycophanta*, L., was also taken near Algeciras. A large *Myrmeleon* with spotted wings was common and very conspicuous.

In July, *Cænonympha Dorus* was plentiful in its locality near San Roque during the first half of the month, and *Hipparchia statilinus*, L., made its appearance on the 2nd, being very common on the 9th, when another brood of *Lycæna bellargus* was out, but was very scarce. *L. argiolus*, L.,* which I had occasionally seen in February and March, was now not uncommon on the Rock, and *Abraxas pantaria*, L., swarmed about the ash trees in the Alameda, which were completely stripped by its larvæ. On the 13th I met with *Pyrgus fritillum*, Hb. (v. *alveus*, Hb.), by the roadside between Campamento and San Roque, but it was very local; and, on the same day, took a pair of *Thecla quercus* flying about an oak tree. The dark form (*eleus*, F.) of *Chrysophanus Phleas* abounded during the month, and, on the 29th, *Pamphila nostradamus*, F.,* was added to my local list, and was common throughout August, being constantly found at the flowers of a heliotrope bush in the Alameda in company with *Lycæna Telicæus*. *Sciapteron tabaniforme*, Rott., also occurred on the Rock.

August was a comparatively unproductive month

the butterflies being now reduced to some dozen species, mostly worn, though I added one species to my local list, *Lycæna Lysimon*, Hb., found sparingly in a waste place near Campamento on the 17th. *Lycæna batia* was very plentiful, much more so than I had ever seen it before, and a few good moths were taken, such as *Rophaia hybris*, Hb., and *Cerura bifida*, var. *urocera*, Bdv., on poplar trunks, and *Megasoma repandum*, Hb., in the larva state near mouth of the Palamones River, where *Orneria dispar*, L., had evidently been abundant earlier in the season, judging from the number of its egg patches on the oak trunks. My chief captures this month were among the *Hydradephaga*, as in a small deep pool in the bed of a winter stream near Campamento, I obtained *Dyticus circumplexus*, F., *Cybister Roeselii*, F., and another *Cybister* with entirely pitchy-black underside (I think *C. tripunctatus*, Ol.), all three in large numbers, with *Eunectes sticticus*, L., *Pelobius tardus*, Hbst., *Hyphydrus variegatus*, Aubé, *Noterus levis*, Sturm, and many small species of *Hydroporus*. I took *Cherocampa celerio*, L., in the town on the 7th, but this is evidently not a good year for hawk-moths. I heard of only one *Sphinx convolvuli*, and saw only one or two larvæ of *Deilephila euphorbie*, L.; of *D. livornica*, unusually common here, I did not meet with a single specimen, and *Acherontia Atropos*, L., was represented by a single larva feeding on the thorny *Solanum sodomæum*, Wild. On the whole, September was decidedly unproductive, and, as the rains have been very late this year, October was but little better, though *Coleoptera* were becoming more numerous towards the end of the month. At the ivy blossom in the Alameda, I am now taking such moths as *Leucania extranea*, Gu., *Agrotis saucia* Hb., and *puta*, Hb., *Lophyrma erigua*, Hb., *Polia canescens*, Dup., *Hadena Solieri* Bdv., *Calocampa vetusta* Hb., *Margarodes unio-nalis* Hb., &c., but all sparingly.

It will be seen that no very great number of species of night-flying moths have been met with by me, but this is probably due to the fact that collecting on the Rock after dark is by no means easy, owing to military restrictions, and is quite out of the question in the adjoining country. The gates of the fortress are closed for the night half an hour after sunset, and should the Entomologist

unfortunately find himself the wrong side of the barrier, he would be compelled to put up with such accomodation as is to be got in the "fondas" of Linea, whose insect denizens would no doubt exact ample vengeance for the slaughter of their fellow creatures during the day.

NOTES AND NEWS.

If you study Nature in books; when you go out of doors you will not find her.—Agassiz.

The streets of Paris have 87,655 trees, each representing a cost to the city of 35 dollars.

Nature informs us that in consequence of the great ravages of insect pests among the agricultural produce of New South Wales, the legislative council have passed a code of laws having for its special object the protection of the insectivorous birds of the colony.

A hybrid between the black currant and the gooseberry has been produced by an English gardener. Its fruit resembles the black currant in size and a red gooseberry in color; it has a hairy covering, and is seedless. The flavor partakes of both the black currant and the gooseberry, being, in the opinion of the originator, superior to either.

A striking reminder of the gaps yet to be filled in our maps of the earth's surface is Dr. O. Baumann's discovery in eastern Africa of a hitherto unknown lake 80 miles long. This great lake to be called Eliasi—is between the Manyara Salt Lake and the Victoria Nyanza, and receives the Wambere River, supposed by Stanley to be the southernmost tributary of the Nile.

In *Nature* for October 6th appeared an interesting illustrated article on the late "Eruption of Etna" written by Mr. G. Platania, and translated from the Italian by that well known vulcanologist Dr. Johnston Lavis of Naples.

We desire to direct the special attention of our subscribers to the notice on page 6 of the covers.

At the recent Botanical Congress which was hold at Genoa, Dr. Caruana Gatto read a paper on "The present state of our knowledge of the Maltese Flora." It will appear in due course in the "Proceedings" of the Congress. We hope to be able to give our readers a resume of it in an early number.

In the course of an article on the "Progress of the Cholera" contributed to the *Scientific American* considerable stress is laid upon the work done and the opinions expressed by the worthy head of the health department of these islands, Professor Pisani, and by his staff.

We would strongly recommend the perusal of the article to every medical man in the island.

Photography is marvellously widening our field of vision. It has shown us millions of stars hitherto unknown, it has revealed astonishing details of animal locomotion and caught the rifle bullet in its flight, and it is now being made to record the movements of the growing parts of plants. Especially curious are the results with certain climbers, such as the hop-convolvulus, ipomoea, etc. The young stems move in a succession of irregular circular or elliptical curves, which vary every moment, even in direction, and are due to irregular growth in different parts of the stem. During the sleep of plants, movements do not cease, but consist of alternate upward and downward vibrations.

In his latest book, Mr. W. Hudson corrects a common error concerning the puma, by stating that on the South American pampas this powerful animal never attacks man except in self-defence, and that even an unprotected child may sleep on the plain in security, Mr. T. B. Comstock, of Tucson, Ariz, confirms the statement, adding that many other animals of reputed ferocity—including the grizzly and cinnamon bears—interfere with man only under strong provocation. He finds the same to be true of venomous reptiles and insects—as the rattlesnake, "Gila Monster," tarantula, scorpion, etc.—which bite only when escape seems to be impossible. Even the Brazilian boa constrictor does not seek human victims, and natives about tropical rivers declare that the alligator harms only drunken men.

A written to the *Zoologist* calls attention to a new danger to the fruit crops. Having had his attention attracted to the rapid decrease in the number of the ripe goose-berries in his garden he set a watch for the purpose of finding out the cause. His curiosity was speedily satisfied. An old rat was seen to cautiously advance towards the bush, and to climb on to the branches, after doing which it plucked the berries and dropped them to his expectant comrades who were awaiting below. This continued for some time, and then another rat ascended the bush and went through a similar performance. The writer set a trap at the foot of the bush and in three days nine of the intruders had to pay with their lives for their *penchant* for gooseberries.

In experiments on the influence of food and surroundings on the color of animals, Mr. E. B. Poulton reared caterpillars of the paper moth under different conditions. Those confined among green leaves and twigs became green, those having black or brown twigs mingled with their food were brown or black, and others were turned light colored by white paper. With artificial colors red and blue tended to produce a dark coloration, though, very strangely, painted twigs had not the same effect as those with the same natural tints. It was shown that the sensory stimulus producing the change did not act through the eye, but through the skin, and consisted of the formation of a definite pigment, being therefore slower than in the chameleon and frog, and capable of modifying the color of a caterpillar only once or twice in its lifetime.

An interesting curiosity, peculiar to the North Islands of New Zealand, is the vegetable caterpillar (*Cordyceps Robertii*). This is an ordinary caterpillar, into which, at a certain season, the almost invisible spores of a fungus enter through the breathing pores. These commence to germinate, when the grub buries itself and is soon killed by the growth of fungus inside it, which ultimately sprouts from one side of the creature's body, and grows to a height of six to nine inches

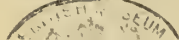
or more. Nearly the entire body of the caterpillar has by that time been converted into vegetable tissue.

The fish are being driven out of the Volga, in consequence, it is believed, of the rapidly increasing trade in naphtha. This substance is conveyed in badly built barges, and the leakage is estimated to be from 2,000,000 to 3,000,000 pounds annually. The fish are decreasing in numbers throughout the river, and have disappeared from the vicinity of the boat landings, while of those still found in places some kinds are so strongly flavored with naphtha as to be no longer eatable. Not only are the fish killed directly, but the infusoria, flies, mosquitoes, etc., which serve them as food, are destroyed. Even the vegetation of the meadows is injured, and the natives collect the naphtha for domestic use.

Coal was hardly used at all 350 years ago, reflects Mr. J. E. Taylor, F.L.S., yet since then Great Britain has consumed nearly half the stock deposited by Nature in its coal cellars many millions of years ago. At the present rate of increase in consumption, what will be the condition of those cellars after another 350 years? It is clearly indicated that this period will witness a marvellous development of economic science. Coal, long before that, as a form of energy will be regarded as a somewhat antique and worked out material. The ebbing and flowing tides, the shifting winds, the waters running to the ocean, perhaps even volcanic and earthquake energy, will have taken its place. Indeed, a line of enquiry and research now going on may possibly affect the commercial interests of the whole world within the short space of the next five years. This relates to the use of petroleum, already being tried on steamers and locomotives of the Caspian Sea and vicinity. The coal-fields of the world will certainly be worked out within an historically brief period, but a distinguished Russian chemist finds grounds for believing that petroleum is still being formed by the action of water on heated metallic deposits, and that the supply will be permanent.

Editor, J. H. Cooke, B.Sc., F.G.S., Malta.

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NOTICES.

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The attention of subscribers is invited to the notice on page 6 of the covers.

The Relationship of the Structure of Rocks to the conditions of their Formation.

By H. J. JOHNSTON LAVIS, M.D., F.G.S., ETC.

Let us now turn our attention to the mineral composition of an igneous rock. Any given magma will produce rock of the most varied character, according to the conditions under which consolidation takes place. Thus, for instance, a given dyke of magma might be a granite near its origin, higher up its sides or whole may be pitchstone, and its centre a liparite or porphyry, whilst at the surface it would present itself as vitreous pumice, an ash, an obsidian or a quartz trachyte. It has been observed that granite veins branch out, and the ramifications may assume the type of felsite, which is of course dependent on the more rapid cooling just as in the case of the salband. Again, we have a series of gradations from a true leucitic basalt, such as the recent lavas of Vesuvius to a sanidine porphyry, to a highly crystalline syenite containing leucite, but more commonly nepheline in the rocks, composing the ejected blocks. The generalization based upon the geological ages being characterized by different types of rocks is false, and is no doubt due to the depth to which denudation has extended. It is a general fact that the slower the cooling takes place the more perfect will the crystallization be.

This we have already spoken of when treating of the difference in the amount of gaseous constituents in a magma which, by bringing about great rapidity of cooling in explosive eruptions, makes the products tend to an amorphous rather than a crystalline condition. One remarkable fact well borne out by the lavas derived from the different eruptions of Vesuvius is that the size of the crystals are much greater in the little oozing forth of a small quantity of lava from the crater than in the great outpour. This will be evident, as in the first case the lava has been in a state of simmering in

the upper part of the chimney for a long time, and will have been losing its heat in a very gradual manner, so that such minerals as leucite and pyroxene at Vesuvius, or the latter mineral at Stromboli, are able to gradually increase in size and perfection, which will proportionally diminish the crystallizability of the remaining vitreous matter. Prof. Samuel Haughton (1) has shown that the remaining paste consists of a very fusible basic glass with an approximate composition of $2\text{RO}, \text{SiO}_2$ containing much iron protoxide. On the other hand a large supply of lava brought up from below with considerable rapidity has little time for the growth of individual crystals, but the whole mass undergoes a microcrystalline change until no, or very little, vitreous matter remains to feed the further increase of individual crystals. We have a parallel in such a case as the following;—If we make a solution of some salt very soluble in boiling water, but very slightly so in cold, and we cause such a solution to cool moderately quickly, the salt will separate itself in a granular crystalline state; but if such cooling be made to take place gradually during many days, very fine, perfect, and large individuals will replace the granular types. Now, when a microcrystallization takes place, it will so separate the remaining vitreous material that even under the microscope little will be discernible, so that it is very difficult to detect it or appreciate its amount. But where suitable conditions favour the growth of large crystals in a similar magma, the vitreous matter that remains will be more concentrated, and therefore more apparent both to the naked eye and under high magnifying power.

The histological character of any cooling magma, with regard to its mineral components, is a question of profound interest, which, up to the epoch of the attempts of artificial reproduction of different types, aided by microscopical research, remained a very obscure subject. When we have to deal with the fused components of any single mineral in a pure state the researches of Messrs. Fougué and Lévy demonstrated that, so far as laboratory experiments go, the critical point of crystallization is near that of the fusing-point of a mineral. We

should, therefore expect that in a leucitic lava, the leucite would be first separated as crystals, to be followed by feldspars, and lastly by pyroxene. It is a well known fact that some of these crystallize simultaneously. This is most strikingly illustrated by a coarse leucitic lava exposed near Orchi, on the volcano of Roccamonfina, where leucites, some two or three centimeters in diameter, enclose many and perfect crystals of sanidine and pyroxene, which in some cases, are entirely enveloped, or protrude a short distance from their surface. One might, with such a series of contradictions, feel inclined to give up further experiments in the laboratory. Before, however, let us compare what has been done by the chemist, and see if it is borne out by rocks as presented to our observation by nature. We will commence by recalling the interesting researches of Sir James Hall (1) who noticed that of such igneous rocks as whinstones and basalts as were fused and cooled quickly, a glass resulted; but by keeping them near fusion-point (*recuit* of modern French authors), or allowing them to cool slowly a crystalline structure resulted. These experiments were followed up by Gregory Wat, (2) who went a step farther, and demonstrated that the sp. gr. increased in proportion to the prolongation of the time of cooling.

The absence of microscopical research prevented any important inferences from being drawn from these early experiments, and it was not till the investigations of Daubrée, Hautefeuille, Freidel, Sarasin Fouqué, Michel Lévy, and others that much advance was made. These authors (3) found by *recuit*, more or less prolonged, the following minerals might be obtained from their fused chemical components Peridotite, pyroxene, nepheline, leucite, triclinic feldspars, mellilite, gehlenite, and sphene; whilst from mixtures not corresponding to the mineral obtained, the following were prepared:—Tridymite, oxides of iron, and perovskite. Many of

1 "Experiments on Whinstones and Lava, 1798;" and also *Trans. Roy. Soc. Edinb.* 1805, vol. v., pp. 8 and 56.

2 "Observations on Basalt and the Transition from the Vitreous to the strong Texture which occurs in the gradual Refrigeration of the Melted Basalt, with some Geological Remarks."—*Phil Trans.*, 1804, p. 273

3 *Encycl. Chimique*, tome ii., *Métalloïdes. Tr. Appendice. Reproduction Artificielle des minéraux et roches.* L. Bourgeois, p. 10.

1 "Report on the Chemical, Mineralogical, and Microscopical characters of the Lavas of Vesuvius from 1631 to 1868." *Trans. Roy. Ir. Acad.*, vol. xxvi., p. 141.

the first group are obtainable from indefinite mixtures. It is this latter point that is undoubtedly the true key to this enigma of the different results in nature, and in the laboratory.

It will be convenient to take up the principal rock-forming minerals one by one and compare their occurrence in nature with their reproduction artificially.

Peridot was obtained, (1) amongst other methods, by *recuit*, at a white-red heat, of the elements of a basalt, exactly identical in all characters with what occurs in nature. This mineral occurs naturally in two forms. The first are irregular nodular masses found as bombs, or entirely enveloped in the lava. From their large size they must have required a long time to crystallize, which took place in all probability before extrusion of the magma. They no doubt, resulted in some cases by actual crystallization from the igneous matter: but I believe, by far the larger part are nothing more than a very advanced metamorphism of a dolomite; for amongst the ejected blocks of Monte Somma or Roccamonfina we may obtain all gradations between the original sedimentary rocks of these masses of pure olivine. The most common form, in a petrological point of view, is the disseminated grains that often go to make up a rock. These are seen to be nearly always one of the first conversions of the amorphous paste into formed material. Yet the actual conditions suitable to its crystallization are not quite

Fouqué and M. Lévy. Bull. Soc. Min. 1881, t. iv., p. 275.

clear; for we find lavas ejected from the same volcano abound with it sometimes, and at others it is quite difficult to find. So far as my observation goes, it favours the basic rocks of fine-grained structure, and especially those that have cooled quickly from a very high temperature, although it seems capable of increasing in size during slow cooling from a very high temperature, in consequence of the lava stream being very deep. This is the case with some very coarse lavas of Vesuvius, such as that of Pompei and Cisterna, which contain some crystals a centimeter long.

(To be continued)

The Birds of Malta.

In view of the interest that has been lately manifested in the "Bird vs. Insect" question, the following list showing the number of birds indigenous to the Maltese islands, and the most common of the non-indigenous species has been compiled.

The remarks on the food that have been appended have been taken from the works of such authorities as J. E. Harting, F.Z.S., and Prof. Saunders. The number of species of birds that actually visit the islands in the course of a year is between 250 and 260, and of these a very great number are insectivorous. In the following list, we have chosen only those birds that are considered to be the most common. It represents 45 species.

1. Indigenous birds.

No	Latin	English	Maltese	Remarks
1	<i>Tinnunculus alaudarius</i>	Kestrel	Spagnolett	Feeds largely on beetles and other insects.
2	<i>Columbia livia</i>	Rock pigeon	Hamiam tal gebel	Grain, snails, and weeds.
3	<i>Corvus monedula</i>	Jackdaw	Ciaula	Chiefly of insects and their larvae & worms.
4	<i>Petrocincla saxatilis</i>	Blue rock thrush	Giambublu	Earthworms, snails, insects, and their larvae and wild berries.
5	<i>Sylvia conspicillata</i>	Spectacled warbler	Bufula tal harrub	Largely on insects, especially <i>Tipulæ</i> , 9 species.
6	<i>Lanius Rufus</i>	Woodchat shrike	Cacciamendula	Largely on beetles and all kinds of insects, especially caterpillars.
7	<i>Passer salicicola</i>	Spanish sparrow	Ghasfur tal beit	Grain, and a small percentage of insects.
8	<i>Puffinus cinereus</i>	Cinereous shearwater	Cieta	Surface fish, offal and small cuttle fish.
9	<i>Puffinus anglorum</i>	Manx shearwater	Garni	Do. Do. Do.
10	<i>Thalassidroma pelagica</i>	Storm petrel	Cangiu ta Filfla	Crustaceans, molluscs, small fish &c.

2. *The most common non-indigenous birds.*

The majority of these stay on these shores for many months of the year.

1	<i>Cypselus apus</i>	Swift	Rundun	Very common. Two sps. feed on insects and their larvæ, and flies on the wing.
2	<i>Caprimulgus Europæus</i>	Nightjar	Bukraik	Two species. Common. Feeds entirely upon insects.
3	<i>Muscicapa Grisola</i>	Spotted flycatcher	Zanzarell	Very common. Feeds principally on insects. Two species.
4	<i>Alauda arborea</i>	Short-toed-lark	Bilbla	Very common. Feeds principally on insects. Two species.
5	<i>Tringasubarquata</i>	Curlew sandpiper	Begazzina hamra	Common. In summer its food is principally insects. In winter crustaceans and molluscs.
6	<i>Alauda arborea</i>	Wood lark	Ciuklaita	Common. Feeds principally on insects.
7	<i>Anthus pratensis</i>	Meadow pipit	Pespus tal giargir	Very common. Six species. Principal food, insects and larvæ.
8	<i>Motacilla flava</i>	Yellow wagtail	Kappamosk	Very common. Chiefly on insects.
9	<i>Rallus aquaticus</i>	Water rail	Gallozz tax-xitua	Common. Five species. Principal food snails and slugs.
10	<i>Coturnix communis</i>	Quail	Summiena	Principal food, slugs, insects, locusts, chickweed etc.
11	<i>Sturnis vulgaris</i>	Starling	Sturnell	Chiefly on worms, slugs, small molluscs, flies, beetles, ticks, and other insects.
12	<i>Oriolis galbula</i>	Golden oriole	Taira safra	Common. Feeds on insects, larvæ, caterpillars, and cherries.
13	<i>Erithacus rubicula</i>	Robin	Petirross	Common. Feeds on insects, worms, bread etc.
14	<i>Upupa epops</i>	Hoopæ	Dakkuka tal pin-nacc	Very common. Feeds chiefly on worms, insects and their larvæ, and flies on the wing.

The above remarks on the frequency with which the birds occur were made by Mr. Wright twenty or more years ago—but unfortunately for the Maltese agriculturist, they can only now be regarded in a relative sense. They are all now, numerically, much less common, and the alarming increase in insect pests which has taken place of late years may be distinctly traced to the wholesale "bird-murder" which is carried on in the islands by netters, trappers, and other classes of sportsmen.

The late eruption of Pantelleria

In October 1891 a considerable sensation was produced among the inhabitants of Pantelleria and the neighbouring islands by a report that a submarine eruption had taken place within a short distance of the Pantellerian shores, and that a new island had been thrown up by the seismic forces.

As usual the reports greatly exaggerated the real facts of the case, and it was not until many months after when Prof. Ricco published a detailed account of the alarming phenomena that the

public were afforded the means of judging of the nature and actual extent of the outbreak. Referring to this subject in the current issue of "*Neptunia*", Sigr. Padovan gives some interesting details of the report of the Italian seismologist in the course of which he gives us the most salient features connected with the outbreak. Prof. Ricco arrived at Pantelleria on the morning of the 22nd of October, that was about five and a half days after the first symptoms had manifested themselves. Immediately after landing he collected all available information relating to the various phases of the disturbances of the preceding days after which he proceeded to the crater-lake "Il Bagno" and made an examination of its profile. The shocks of earthquake which accompanied the submarine phenomena had been severely felt by the Pantellerians, and were clearly evidenced in a fracture which was found running in a S. E. direction from the edge of this old crater for a distance of about fifty meters. After having thoroughly surveyed the island the Professor proceeded in the steam launch "*Bausani*" to the scene of the eruptions. Jets of steam and large bombs of considerable size and consisting of a black scoriaceous

pumice were being ejected in all directions to a height of several meters.

Many of these blocks on reaching the surface of the sea exploded throwing out jets of steam in all directions while others, exploded with a loud report and gave rise to a strong smell similar to that of pyric powder. The temperature of these blocks was considerable, often being as much as 415° C. The professor's explanations for the formation of these bombs are of so much interest that we insert them here in full. "The melted lava says the Professor whilst rolling down the sides of the submarine crater probably enclosed considerable quantities of the water in which it moved. Then as the melting point of the lava is higher than 1000° Fah, the water thus imprisoned must remain in a spheroidal state i. e. liquid without passing into steam. But on the lava cooling, the temperature falls also in the inside and the enclosed water is then vaporized, and an enormous pressure of steam is exerted. As it is probable that under these conditions that the lava may preserve much of its original plasticity, therefore when the water is converted into steam, the lava probably expands. A vacuum is thus created and the bomb formed being rendered lighter than the volume of water which it displaces rises to the surface. During its ascent however the hydrostatic pressure of the sea-water diminishes, and at a certain point, especially at the surface, where the pressure suddenly diminishes the tension of the enclosed steam exceeds the outside pressure and an explosion results in the course of which steam and fragments of pumice are hurled to considerable distances in the air, and the peculiarly smelling gases are diffused through atmosphere. Alluding to the causes which gave rise to the eruption Professor Ricco observes that on the day when the eruption broke forth (October 17th) the sun and the moon were nearly opposite to one another and in a line with the meridian of Pantelleria.

Entomological Notes.

Ceocroampa celerio L.—A specimen of this beautiful and uncommon hawkmoth, which has never as yet been noticed in Malta, was given me on the 12th October last by Mr. J. Cooke F. G. S., who

had taken it the preceeding day in his house at St. Julian's. Another specimen was a few days after taken in Valletta by Mr. Briffa, and I was shown later on two more specimens also taken in Valletta. It is well known that its larvae feed on the vine.

Sphinx convolvuli L.—This moth is never a rare species here, but I have been struck by the great numbers of it I have seen in September and October in all places where there were *Pancreatii* in flower.

Deilephila euphorbiae L.—The caterpillar of this moth, after the first rains, from September to December, and often till spring time, may be seen in numbers on our common spurge—*Euphorbia pinea*. I have constantly observed that the colour of our caterpillar is very much lighter than that which is given of it in all Entomological works. It changes into pupa generally before winter and it comes out late in the spring or in summer, but I have had pupae which came out only after fifteen or sixteen months.

Colias edusa and its *var helice*. Mr Cooke has remarked to me the abundance of this butterfly in Malta. I cannot help noticing this, but the *edusa* is always very common here in autumn; it is more so this year, because all butterflies are rather more frequent than usual. Rains fell early in September and we have had fair weather since, there is therefore a precocious growth of plants and the larvae had full time to develop. *Vanessa cardui* is not less abundant. A few weeks ago I was rumaging under stones outside Porta Reale when a street boy came to me and offered me a boxfull of chrysalides of this species, which I declined to have; I can vouch there were thousands of pupae in that box together with the colias, I have in a much smaller proportion, with its *var helice*.

A. C. G.

SCIENCE GOSSIP.

New Zealand has set apart two islands for the preservation of its remarkable wild birds and other animals, forbidding therein all hunting and trapping.

Holland is considering the draining of the Zuider Zee, a sheet of water covering 730 square miles.

A steel-like grass from the volcanic slopes of Oran, Algeria, is said to be so elastic that it can be used instead of springs in the manufacture of furniture.

After the present year, the Centigrade thermometer is to take the place of the Reamur as the official standard throughout Germany.

At present 150 species of plants are cultivated in Egypt, but Dr. Schweinfurth finds that only about 50 were grown before the Christian era.

A remarkable continuance of an inherited practice is that of migratory birds which are said to cross the Mediterranean at a point proved to have been once the narrowest part of the sea, but which is far from being so now.

A solution for checking potato disease—consisting, for an acre, of 22 lbs. sulphate of copper, 22 lbs. unslaked lime, and 100 gallons of water—was lately tried on an English experimental farm. The unsound tubers from a treated plot weighed 11 lbs.; those from an untreated plot, of exactly the same size and number of plants, 686 lbs.

Certain curious leaf-insects of the tropics have wings that mimic leaves not only in color but in the veins, and on the ground so closely resemble leaves that even ants are deceived. Dr. Sharp tells the London Linnean Society, moreover, that this resemblance amounts almost to identity of minute structure, and the coloring matter cannot be distinguished from that of leaves. Even the eggs have a strikingly vegetable appearance.

The popular belief that the increase in the size of glaciers recurs every seven years has not been confirmed by the studies of Prof. Forel, who finds that while definite figures cannot be given—the cycle of glacial variation must be as much as 35 to 50 years.

The glaciers of the Alps seem to have been at maximum in 1850 or 1855, and they continued steadily to diminish until 1870, when not one was known to be on the increase. In 1875 a glacier of Mont Blanc began to lengthen, two others began to increase in 1878 and 1879, and this was soon followed by an increase of some 30 glaciers of different valleys of Le Valais. Many large glaciers,

however, are still decreasing or stationary, and it is probable that the maximum stage of glaciers will not be reached until the beginning of next century.

From many observations and experiments Mons. Ph. Lenard finds that drops of water falling upon water or wet bodies generate electricity, the water becoming electrified positively, and the air escaping negatively electrified from the foot or the fall, and light impurities in the water diminish the effect considerably. The essential conditions of electrification are the concussions among the drops themselves and against the wet rock, no effect being due to the waters fall through the air and its dispersion by it. A jet of water falling, from an insulated tank to an insulated pail electrified the latter positively, while the negative electrification of the surrounding air grew to several hundred volts. Sparks were obtained from waterfalls.

The strength of England and of the English race in North America, says Prof. N.S. Shaler, the dominance in the world of that peculiar kind of man, depends upon coal; and this in an immediate way hinges upon the peculiar conditions of geographic development which caused the plain-lands of North America alternately to sink into and rise from the sea in perhaps a hundred oscillations in in the course of one geological period.

In its life forms Australia is known to be strangely different from other lands, and reasons have appeared for looking upon it as a survival of the Secondary and Tertiary periods—a region that has grown old less rapidly than the rest of the world. "We know," observes a writer in *Science Gossip*, "that within the period called Tertiary, gum-trees, banksias, Moreton Bay pines, and other now distinctly native Australian trees, grew in England. During the Secondary period the only warm-blooded mammals in Europe were marsupials, resembling those peculiar to Australia. Every now and then some new fossil mammal turns up, but it is almost certain to be of the Australian type. For instance, a large number of fossil mammalian bones have just been discovered in the Tertiary strata in Patagonia, and they have been proved to be nearly related to the pouched or marsupial wolf (*Thylacinus*) of Tasmania."

The place once occupied in the interest of the scientific and the curious by Chang and Eng is now filled by Radica and Doddica, two little girls from Orissa, India. These bright and pretty children are $3\frac{1}{2}$ years old. They are united by a flexible bony attachment from breast to breast, and below this is a visceral connection. There is only one navel. Food given either satisfies both, and medicine given one effects the other in a less degree. A sentence begun by one is often finished by the other. The flexibility of the connection is shown by the fact that when sleeping, one child lies on her side and the other on her back. These remarkable twins the Scientific American informs us will appear at the World's Fair.

The best known glaciers, remarks Mr. W. B. Dunning, are in Switzerland, where some 400, varying in length from five to fourteen miles, are scattered through the Alpine valleys. Their width varies from half a mile to one mile, and their greatest thickness is estimated at about 1000 feet. But these are insignificant when compared with some Greenland or Alaska glaciers. Muir glacier, for instance, occupies a tract some 30 or 40 miles wide, from which nine main streams and seventeen branches unite to form a grand trunk, that pushes a mighty wall of solid ice, 500 feet wide and 700 deep, into Glacier Bay. The great Humboldt far outstrips this, being fully 115 miles wide and some 2000 feet thick. Nordenskjold, who penetrated 123 miles inland, was unable to find its end. In all probability, it is an arm of one gigantic field of ice, capping the interior of Greenland, and moving gradually but ceaselessly toward the sea.

The obelisks of the Pharaohs were cut from red syenite, a rock often misnamed granite. In the quarries of Syene, according to the writer of "Cleopatra's Needle," may be seen an unfinished obelisk, adhering to the native rock, and still clearly showing traces of the workmen's tools and the method employed in separating these immense monoliths. The edge of the block is marked by a sharply-cut groove, containing holes evidently bored for wooden wedges. In completing the operation, the wedges were firmly driven into place and the groove was filled with water, when the swelling of the wood split the rock throughout the length of the groove.

The block was afterward slid on rollers to the edge of the Nile. Here a large raft was built about it, and at the next inundation the finished stone was floated down to the city where it was to be erected, and was pushed by thousands of hands on rollers up an inclined plane to the pedestal prepared for it.

The sun's rays pouring on the desert of Sahara, says Mr. W. H. Preece, are generating the equivalent of millions of horse power in the heat absorbed by that great sandy waste. Sunshine is power, Coal is merely preserved sunbeams. The solar heat acting on one acre in the tropics would if it were possible to utilize it, produce 4,000 horse power for nine hours every day. To utilize this heat is not a mere dream: it is certainly possible to convert it into electrical energy by thermo-electric apparatus, though we have not yet heard of its being done. The earth itself in its daily rotation round its axis is an immense store of energy, if we could by any means reduce a little of this spin we should lengthen the day, but we should obtain energy. Mr. Gisbert Kapp has calculated that if the day increased only one second 1000 years we should during the whole of the century obtain 10,000,000 horse power continuously. There is no doubt that the tidal wave is gradually acting upon the earth's spin in this way, but the energy is not available for man, and is wasted.

It is believed, according to Mr. P. L. Simmonds, F. L. S., that there are five times as many insects as there are species of all other living things put together. The oak alone supports 450 species of insects; and 200 kinds make their home in the pine. Forty years ago Humboldt estimated that the number of species preserved in collections was between 150,000 and 170,000 but scientific men now say that there must be more than three-quarters of a million, without taking into account the parasite creatures. Of the 35,000 species in Europe, however, not more than 3,500 are noxious or destructive. There are more than 100,000 kinds of beetles. Such being an enumeration of the different forms, what an array of figures would be require for tabulating a census of individual insects each a distinct living thing. Some single species include an incredible number of specimens. The

locust on the coast of the Mediterranean, for instance, sometimes cover the ground inches thick for miles, while a few years ago 14,000 bushels of locust eggs were collected in a single season in three Algerian provinces. A single house fly lays from 150 to 200 eggs, which in two weeks become equally fertile flies, and insects generally have astonishing powers of multiplication.

Alluding to the work on the Maltese Echinoidea lately published by Mr. J. M. Gregory of the British Museum *Natural Science* says. "Though Malta has for so long a period belonged to the British Crown, its geology is still imperfectly known. A good deal of confusion has been caused by want of exactness in the determination of the fossils; still more by mistakes as to the horizons and localities from which they were obtained.

At last however, the careful observations and the fine collection of Maltese fossils made by Mr. J. H. Cooke, are providing material for a better understanding of the Geology of the Island; and in a memoir just issued by the Royal Society of Edinburgh ("Transaction," Vol. XXXVI., pt. III).

Mr. J. W. Gregory has availed himself of the opportunity to revise the Echinoidea, while making an analysis of the evidence they provided as to the age and origin of the Tertiary strata of Malta. Mr. Gregory comes to the conclusion that the strata in question belong partly to the Oligocene partly to the Miocene period, and that they probably range from the Tongrian to the Tortonian. The evidence brought forward of changes of depth, as shown by the Echinodermus, is curious. The Tertiary series in Malta begins and ends with shoal water deposits, but the intervening strata indicate deep water."

Civilization, observes Dr. Service G. Ganes, receive its primary impulse and has achieved its most notable successes in the temperate zone, and among races which are neither exclusively vegetarian nor exclusively carnivorous in their habits. The northern American and European, as is well known, is a descendant of one or more branches of the ancient Aryan or Indo European stock. It so happens that one branch of this stock which early separated from its European cousins and travelled southward to the mountains and plains of India, through stress of climatic and religious influences, became as near-

ly exclusively vegetarian as any large section of the human race has ever been, and has remained so for centuries. Here, then, is an opportunity for comparison. The effect of the vegetarian habit, superadded to climatic conditions, has been to develop a race notable indeed for some of its intellectual traits, but inferior in size, lacking in physical stamina and energy of character, whose millions of people easily fell a prey first to the Mohammedan and afterwards to the English, whose commercial enterprise for centuries has proved inferior to that of the small competing race of the Parsees—their nearer blood relation—and which has shown itself lacking in those essential traits which characterize our modern, progressive civilization. The great and successful men of all ages have been those who have not departed too widely from the mixed diet which has long constituted the habit of the races which have peopled the temperate Zones of the earth.

A study of the phenomena of marine life, writes Mr. Geo. W. Field, is capable of producing a greatly increased food supply for man. The necessity of cultivating the marine resources is even now apparent and many governments have already begun to cope with the question, by the establishment of commissions of fisheries. Of these commissions that of the United States stands in the front rank by virtue of its positive results. But in the near future individual attention must be turned to supplementing the terrestrial resources, the wheat fields, the cattle and sheep ranches, by an increasing utilization and development of the possibilities of marine farming; by fish propagation by plantations of oysters, clams and scallops, by raising herds of lobsters and crabs. Improved breed of fish and of lobsters, will result. The possibilities are well-nigh limitless; and by cultivation of the sea and sea bottom as well as of the land, man will postpone indefinitely the fulfillment of the Malthusian prophecy.

Apropos of this subject it is surprising, when we consider the position of the Maltese Islands, their varied and extensive sea-board, and the unusual facilities that they offer for investigations into sea-life, that advantage has not been taken of these facts to advance our knowledge of Mediterranean zoology and biology by the establishment of a

Marine biological laboratory. The multifarious and mixed nature of the duties which the present professor of Natural History in the Malta University (he is professor of every branch of natural history, of zoology, of hygiene, of forensic medicine as well as curator of a museum, and director of the botanic gardens) is called upon to perform absolutely prevents him either from pursuing any special line of research, or from giving adequate attention to the many economic problems which are constantly cropping up, and with which the most vital interests of the people are intimately connected.

As this is a subject in which the Maltese people are specially interested, if not from a scientific, at least from an economic point of view, we shall have more to say on it in a future issue.

The Canary Islands.

The latest Foreign Office report on Spain contains a comprehensive pamphlet on the social and economical conditions of the Canary Islands, by Mr. Samler Brown. About 1490 the Canaries were partly planted with sugar and large profits realised, until, in the sixteenth century, the islands were unable longer to compete with the West Indies. Recently a fresh start has been made by means of British capital; and now there are several steam factories in Grand Canary and one in Teneriffe. From 1490 to 1850 the vine thrived on the islands, but at the latter date it was destroyed by the ravages of a fungus; the European had to be replaced by American vines, and the quality of wine has greatly deteriorated. The trade, however, has rapidly revived since 1885, and the vine will probably again become the most important of all the products of the country. Cochineal was originally brought to the Canaries in 1826, and after some prejudice had been overcome it was found that the dye was produced more plentifully and of better quality than in other countries. The discovery of aniline dyes brought about a crisis, and the export of cochineal has rapidly decreased. The attempt to replace cochineal by tobacco has proved a failure. The land is now largely planted with tomatoes, bananas, and oranges, and the Canaries are becoming a market garden for Northern Europe, earlier by several weeks than the Channel Islands. The

steepness with which the coast lands rise upwards to the hills occasions a succession of zones differing in temperature, nature of soil, and other conditions. There are five climatic zones, the limit of cultivation rarely exceeding 4000 feet. The forest land begins at an elevation of about 3000 feet, and the greatest height at which any shrub is found is about 11,000 feet. The Spanish Government has ordered the planting of young trees, and prohibited the previous reckless waste. There is no record of freezing-point being touched at Laguna, 1840 feet, the highest point at which regular meteorological observations have been taken for a series of years. At Vila Flor, 4335 feet, the lowest temperature recorded was 28°. The highest summer record was 104° at Laguna; the ordinary summer temperature in towns by the sea averages 82°. The annual rainfall at Las Palmas is 8·35 inches, in Laguna 29·41. In the western islands droughts are unusual, but in the eastern, specially in Fuerteventura, great distress is occasioned. The islands of Hierro and Fuerteventura have no springs, and Langarote has very few. These depend simply on the dew and rainfall. Grand Canary possesses by far the best water supply; Teneriffe could profitably use for irrigation ten times as much water as is available. The water is carried from the springs in watercourses of stone, and by evaporation, leakage, or robbery, a large percentage is lost. An estimate for 1869 states that all the cultivated land, including woods, vineyards, and pasturage, amounted to 845 square miles; in 1890 the total amount of irrigated land in Teneriffe and Grand Canary was, 15,000 acres. The deep water between the shallow banks on the West African coast and the Canary Islands affords one of the best fishing-grounds in the world. The kind of cod caught is said to be superior to that got on the Newfoundland bank; while there are tunny, porpoises, seabream, and many other species of fish. The fisheries have never been properly worked, and are now carried on in a very half-hearted fashion.

Journal R. G. S.

New diseases of the vine

Prof. P. Viala and C. Sauvegeau have recently published a work on two diseases of the vine which have been added to the many known before.

They call them *la Brunissure* and the *Californian disease*, and they have found that they are caused by two endocellular myxomycetes *Plasmadiophora vitis*—and *Plasmadiophora californica*.—The former disease was noticed in France in 1882 for the first time, and it has been spreading ever since in an alarming manner. The other till now is restricted to California and has not as yet made its appearance in Europe. The Government in France has forbidden all importation of vines from California and it would be well that we should adopt some restrictive measures, now that, on account of the *Peronospora* in our vines, it has been suggested to introduce American ones as the less subject to this last mentioned disease. With regard to the *Brunissure* Prof. Cuboni in "*La difesa dei parassiti*" informs us that it has been already found in various localities in Italy and even in Sicily; it would be well therefore to keep our eyes open also to this new enemy which threatens our vines so closely.

The *Brunissure* appears on the leaves, on the upper surface of which, irregular brownish spots begin to appear, these then extend to the whole leaf which maintains its green colour only at its edge and near its nervature, the petiole assumes a dark brown colour, and finally the whole leaf turns into a dull greyish brown and falls. The disease in the leaves then stops the ripening of the fruit, the development and all the functions of the plant. It has been experienced that the remedies used against *Peronospora* are of no value against the *Brunissure*.

A. C. G.

Comino and its islets.

"There are more things in heaven and earth Horatio than are dreamt of in thy philosophy."

Between Malta and Gozo, lies an islet that is almost as unknown to the majority of the inhabitants of Malta as are the wilds of Africa, or the plains of Siberia. Viewed from the north, its low-lying shores, with their bare denuded surfaces, present a most uninviting, not to say savage aspect. All that tends to beautify a landscape is there absent. Its surface contour assumes a monotonously undulating form, which is unrelieved by all vegetation save a few scrubby plants, that endeavour to eke out an existence in the hollows of its honey-combed

surface. Even the softening effect, that an integument of soil imparts to a landscape, is there wanting; and the scanty earth, that has been derived from the erosion of the rocks around, lies in small patches at irregular intervals, and serves rather to increase, than to diminish the savagery of the prospect. And yet I dare say there are few, who after a first visit, have not experienced a desire to renew their acquaintance with it.

The romantic scenery of the western coast of Comino offers attractions, that are at once the wonder and delight of all who behold them. Unlike the northern and southern shores, those of the east and the west, present to the Mediterranean waters a succession of precipitous cliffs and weather beaten headlands, that attain a height varying from 100 to 180 ft. Compared with the cliffs on the south coast of Malta, they are insignificant; but their want of altitude is fully compensated for, by the wildness of their contour, and the picturesque groupings of the detached masses that lie along their bases. All of the energies of the devastating forces of nature have been concentrated on the work of destruction and have left behind indelible records of the terrible rigour of their attacks. Rock masses have been torn away and hurled to incredible distances, thus forming a series of sunken reefs, and fantastically shaped islets, which, in tempestuous weather, are at once the refuge of the myriads of gulls and rock pigeons, that have there fashioned a home, and the dread of the fishermen, who gain a scanty livelihood, by toiling in the surrounding waters. The mural cliffs of many of these islets tower to a height, that is but little less than that of the cliffs of the formation of which they once formed a part; but, while possessing all the majesty of proportion of the parent bed, they have also a rugged beauty so entirely their own, that it constitutes a feature in the sea scape, which by the contrast, tends to bring other not less remarkable features quite into position of subordination.

It is to the north-east wind, that these disastrous effects among the cliffs and precipices of the islands are to be attributed. This wind blows during the winter time, with unremitting fury for many days together; and one has but to watch the huge breakers, that are then raised, and hurled with resistless violence against the shores of the islets, to be able to form a good idea of the magnitude of

their power, and of the amount of destruction that they are capable of effecting. The atmosphere too takes no mean part in these operations; but its efforts are chiefly confined to the softening down of the angularities which the constant fractures in the strata, have given rise to. But extensive as is the amount of work for which it is responsible, its effects can, in no way, be compared with those wrought by the action of the sea waves. Even the least observant, in the course of a ramble around Comino's shores, cannot but be forcibly impressed with the truth of this assertion.

Whenever the waves have been unsuccessful in their attempts at destruction with one set of operations, they have fallen back upon their exhaustless resources, and have utilised another set. Where sheer force has failed, they have employed more insidious methods to attain their end; and thus, masses, whose bulk and weight have enabled them to successfully withstand the tempests of centuries, have yet been compelled to yield to the silent working of those less ostentatious, though not less formidable enemies, which, with never tiring zeal, have perforated them through and through, thus forming caverns and archways of intricate forms and of majestic proportions.

There is no more pleasant way of passing a hot summer's day, than by taking a boat, and leisurely rowing through the mazy windings of the cliffs, crags, stacks, caverns, archways and buttresses, that abound along the coastlines of these islets. After the monotonous aspect of the surface of Comino, with the sterility of its scanty soil, and the solitude of its deserted slopes, sights such as these scenes of devastation supply, give rise to a train of reflections, which when warmed into life by the sublimity and grandeur of nature, seem to infuse a new spirit into one's being.

Cala Hein, a little bay between Comino and Cominotto, is one of the first places that should be visited. The romantic arrangement of the rocky islets with their arches, beetling cliffs and caves, would, of themselves, be sufficient to awaken a spirit of interest within the soul of the most lethargic; but when the waters of the little bay, with their encircling mantle of green waters are seen ornamented by the golden effulgence of the rays of a setting sun, with their variegated hues shimmering in its beams and reflecting a thousand

brilliant imageries, then it is that the spirit awakes and the mind, no longer lethargic and indifferent to the beauties around, gives itself up entirely to the enthusiasm that then takes possession of it. The scene that is presented to the view from the lofty summits of the cliffs of Comino, offers some charming contrasts; but it cannot be compared with that which this little bay and its surroundings afford. On a bright day, its waters present an endless succession of the most brilliant colours, which commence with a deep blue, and thence passes through every conceivable gradation of green, orange, and white, after attaining the last of which, it again graduates onward in the distance, to that cerulean blue, that is so characteristic of Mediterranean waters. Nor is the setting less effective than the picture. The rays of a tropical sun diffuses a silvery sheen, that hangs over the whole like a soft transparent drapery; while the countless reflections, from the wavelets that play in the path of every beam, scintillate and sparkle, with a lustre, such as even the Kooh-i-nor—though it might equal—could never excel.

The sombre looking entrances to the caverns and the wildly fantastic shapes that many of them assume, form an appropriate contrast to the calm stillness and rich colouring around; and thus heightens the effect of a scene that cannot fail to impress, and being impressed will never be recalled without conjuring up a host of the most agreeable of reminiscences. A few strokes of the oars only are necessary to take one well within the depths of most of these water-worn hollows. The lapping of the tiny wavelets, that fling themselves playfully against the sides of its inner recesses, gives back an endless succession of echoes, and affords an opportunity of judging of the volume of sound that must réverbérate through them, when tempest-born waves are hurled into their depths. Each of these caves has some peculiarity, either in form or structure. Each of them possesses features of an essentially different nature, so that the instruction and pleasure, that is to be derived from their examination is practically unlimited. The first one met with, after entering the strait between Comino and Cominotto, is situated on the shore of Comino. It has an entrance, so small, that is only with the greatest difficulty that a boat can be steered safely through it. And, yet,

when within, and the eyes have become accustomed to the Stygian gloom that pervades its depths, it will be found to open out and assume proportion of a truly surprising magnitude. The floor of the cave is strewn with sunken reefs, among which the wavelets leap and dance, and finally fling themselves playfully forward upon the pebbly beach, that has been heaped up at the farther extremity. The music of the waves, the weird gloom of the surroundings and the solemn grandeur that pervades all, conjure up a host of emotions. Delight, terror, wonder and awe, each in turn endeavours to assert itself. But while each is unsuccessful in its individual endeavours to monopolise the mind yet their united efforts have the effect of imparting to it feelings so pleasurable, as to render the pang of regret, that is experienced when the time comes to turn from such scenes, doubly poignant in its nature and effects.

For the geologist, the sides of this cave will prove to be of unusual interest, as they literally teem with the remains of those creatures that formerly lived and died in the waters when the islands were undergoing the processes of formation. Crossing over to the islets on the opposite side, other caves will be found, some squat and irregular in their outline, others all that is graceful and symmetrical. Caves, in whose wave-wasted sides, broad platforms have been scooped out, and filled with crystal waters, so cool and refreshing, that they might almost serve as baths:—

"Wherein sea-nymphs might lie

With languid limbs, in summer's sultry hours."

In the back-grounds of most of the cavernous countless rock-masses are to be seen that have been detached from the roofs and sides by the incessant action of the sea. All of them have been much water-worn; and, in the softened sunlight, with their rough angles and honey-combed surfaces, they often present the most fantastic of appearances. The archways, too, that grace the islets offer us some striking examples of natural power and design; and form prominent objects in this picturesque seascape. They occur in every stage of formation, in every stage of perfection, in every stage of ruin.

Shattered columns, broken pediments, and the debris resulting from the collapse of roofs and spans, lie scattered in pell-mell confusion; and,

but too plainly demonstrate, how inexorable are the laws of nature, and how relentlessly she applies them. On the western shore of Cominotto lies one of these partly demolished, natural bridges. It had been scooped out of an islet, that laid about 50 yards from the island and is now supported on either side by columnar masses of hard gray limestone. The span of the archway has been broken in the middle, and the two halves have fallen and jammed themselves into a V shaped roof, against the inverted ridge of which the heaving waves upraise their crests and break them into a light frothy foam. How long it has remained thus, who can say? But judging from appearances, it does not seem to be destined to weather out many more storms. The collapse of any one part of it will be the signal for the demolition of the whole structure. Immediately beneath the Tower stands a ruined archway, the one side of which has broken away, and, with the roof, has tilted inwards and formed a series of colossal steps, such as Brobdingnagians only, could have utilised. But of all the picturesque sights with which this truly delightful spot abounds, none I think, will compare with the gorgeous colourings, with which the interiors of many of the caves are decorated. Nature has, indeed, been lavish with the contents of her palette. The waters of Cala Hein are rich in hues that a Turner might despair to imitate; but even they dim before the tints, with which these rocks have been embellished. At the sea level the sides of the reefs and caverns are clothed with a profusion of marine vegetation.

"Their glittering textures, like the filmy dew

Dipp'd in the richest tincture of the skies.

Where light disports in ever-mingling dyes,"

which rises and falls with every ripple that surges against them.

The sombre shades of the weeds present a pleasing contrast to the vivid tints of the rocks to which they have attached themselves. Every shade of the spectrum is there represented, but that which predominates over all of the others, is a bright vivid green, a green, such as we sometimes see in the winter time crowning the heights of the western Binje-nmas, when the setting sun, resting like a golden crest upon their summits, throws its beams aslant the verdure covered slopes.

The interiors of most of the caves are coloured

in this manner, and if viewed on a bright day, when the sun is shedding its rays obliquely across the entrances, the sight will be one, that will not easily be forgotten. My visits have been many; and yet I am looking forward with pleasurable anticipations to the next. They never fatigue; they never pall. Inexhaustible in their objects of interest, every fresh visit is productive of new pleasures. The wonder is, how little is known of these charming spots; or, if known how little they are appreciated. Nature there seems to have clothed herself most fantastically, most picturesquely.

To the lover of Nature, to him who can indulge his imaginative faculties in conjuring up scenes of the past, for the purpose of comparing them with those of the present, who can discover in the vicissitudes of bygone ages the constitution and mode of working of those forces that have been the cause of such differences in the surface contour; to such, the varied scenery that the ravines, gorges and coast-lines of the islands present will afford a never failing source of pleasure; but to those that have not cultivated these perceptions, the low-lying shores, the craggy cliffs, mural escarpments and fantastically formed caves will be of as uninviting a nature as was the journey to Sadak, when he was in search of the waters of oblivion.

The Italian Geographical Congress of 1892.

The first National Geographical Congress of Italy was held at Genoa, from September 18th to 25th. The Congress held at Venice in 1881 was one of the series of International Congresses, held at Antwerp, Paris, and Berne, and to be held in London in 1895. It was a great success. The weather was magnificent; the attendance, chiefly Italians, was numerous; Genoa, always superbly beautiful, looked at its best. As is well known, in the preceding week the fourth centenary celebration of the birth of Columbus in this, his native city, took place amidst much pomp and splendour in the presence of their Majesties the King and Queen of Italy. The Geographical Congress commenced after the close of the festivities. There was an Exhibition of Arts of a general kind, and also a Geographical Exhibition, special to the work of the Congress, in a separate building.

H.R.H. the Prince of Naples was the Patron; H.R.H. the Duke of Genoa was the Honorary President, and took a personal share in the proceedings; the ex-President of the Italian Geographical Society, the Duke of Sermoneta, and three other Senators of the Kingdom of Italy, were Honorary Vice-Presidents. The actual President was Marquess Doria, the President of the Italian Geographical Society. Professor Giuseppe della Vedova, the Secretary of the above-named Society, who is so well known to, and highly esteemed by, many English friends, discharged the office of Secretary of the Congress.

There were three Sections, as follows: (1) Scientific, embracing mathematics, physics, &c.; (2) Economic, and embracing political divisions, statistics, commercial and social features; (3) Educational. General and sectional meetings were held, and the time available was distributed to suit the convenience of members. An order of the day was published and distributed each morning. Each Section had its president and vice-president, and secretary; the former were elected daily.

In each Section certain subjects were put down for discussion, and certain papers received as communications; and the subjects were numerous and well chosen. The meetings and the Central Office were held in the Palazzo dell'Università, Via Balbi—a magnificent building. The general meetings took place in the great hall, and the Sections were held under the same roof, in side rooms.

The inaugural meeting was held on Sunday, the rest of the week being taken up with the business of the various sections.

H.R.H. the Duke of Genoa and the African traveller Casati were two of the most prominent figures at these daily meetings.

On Sunday, the 25th, there was a ceremony in the grand hall of the University, in the presence of H.R.H. the Duke of Genoa and a very large assembly of the general public, as many of the Congressionists had left, in honour of the great navigator, Christopher Columbus. It had been arranged that a representative of each country and each learned society should have the opportunity of speaking for five minutes, in the alphabetical order of the country, in their native language. Professor Della Vedova, the secretary of the Congress and of the Italian Geographical Society, led the way

with an interesting description of the difficulties overcome by the iron will of the great navigator. He was followed by eleven speakers: but unfortunately the newspapers of Genoa were unable to report in detail the eleven speeches. Signor de Carvalho, from Brazil, was the first in order; General Muktar Pasha, the delegate of Egypt, followed, partly in Arabic and partly in French; to him followed Professor Levasseur, of the French Geographical Society, in French; then came Professor Wagner, for Germany, in the German language; he was succeeded by Mr. Steinthal, in English, who expressed his admiration of the success of the Congress; and as Dr. George Smith, LL.D., the delegate from Edinburgh, had been compelled to leave Genoa, his place, by request, was taken by Miss Maria Cust, a member of the Congress, whose address, in the English language, was greeted with the applause of the assembly, and H.R.H. the Duke of Genoa, rising from his seat, shook hands with her before she sat down.

Professor Muller, for Holland, addressed the assembly in Dutch, and concluded his remarks in Italian. He was loudly applauded. To him succeeded Doctor Negruzzi, from Roumania, and General Semenoff, the delegate of Russia, each in his native language; Colonel Julio Segui y Sala, the representative of Spain, in full uniform, followed with a magnificent oration in Spanish; Professor Efflinger spoke in the French language as the representative of Switzerland; and finally Signor Polleri closed the remarkable exhibition of sympathetic admiration by a speech in Spanish, as representative of Uruguay, in South America.

The Syndic, Baron Podestà, followed with a speech in French; and then the President of the Italian Geographical Society, the Marquess Doria, presented to the African explorer, Gaetano Casati, the gold medal of the year. H.R.H. the Duke of Genoa shook him by the hand, and congratulated him on the honour. The celebrated African missionary and scholar, Abbé Beltrame, then obtained leave to propose a message of good wishes to the Italian colony now settled on the Abyssinian sea-coast, and to its governor. This was voted by acclamation.

At 3 P.M. the final general meeting took place; the business was chiefly formal. It was:—The next Italian Congress should be held at Rome in

1894; votes of thanks were passed: the Countess Ourvaroff, representative of the Geographical Society in St. Petersburg, made a short speech in French to convey a vote of thanks to the President of the Congress. At night there was a banquet in the Sale del Ridotto, at the theatre, presided over by the Syndic of Genoa, who was the host to the two Congresses—Geographical and Historical; there were some excellent speeches. The usual toasts followed, and the next morning the Congressists dispersed.—[R.N.C.]

Botanical Notes

By MAJOR M. J. GODFREY.

In the early part of October the small but very graceful *Narcissus serotinus* was abundant at the Wied Incita, growing in company with *Scilla autumnalis* and *Muscari parviflorum*. A flying visit to the same valley also produced *Triglochin barleri*, and *Ajuga iva*, whilst *Inula saratilis* *T. graveolens* and *T. viscosa* were of course plentiful, the latter looking like broom in the distance with its masses of bright yellow flowers. *Carthamus lanatus* was also found, whilst the pretty soft fluffy balls of *Conyza ambigua* were noticeable everywhere. Some of the rock pools were full of *Zannichellia palustris* but of course not in flower. While going to Boschetto on the 14th October I found *Pulicaria dysenterica* with its yellow flowers and *Chenopodium ambrosioides* growing freely by the road-side. Near Verdala *Colchicum bertolenii* var. *cupani*, *Carlina gummifera* and the universal *Nepeta calamintha* were abundant, and *Crocus longiflorus* was subsequently found in profusion in the neighbourhood. *Smilax aspera*, with its pretty, sweet scented flowers, was also seen, as well as *Spiranthes autumnalis* the only Maltese orchid which flowers at this time of the year. Some of the flowers of the *Colchicum* and of the *Crocus* were perfectly white. After much search *Clematis cirrhosa* was also found, but it does not appear to have flowered this year, the plants being small and weak. On the 25th a few flowers of *Narcissus tazetta* were gathered for the first time and early in November it was obtained in great quantity. The season appears to be an unusually forward one, as *Delicata* gives December to March as the flowering-time of this narcissus. *Asparagus*

acutifolius too, whose flowering months are September and October, was everywhere in fruit early in the latter month, and I did not find a single plant in flower, although a magnificent spray of its flowers was gathered in October last year. A double variety of *Ranunculus bullatus*, and an unusual form with a branched flower stalk were met with in the Zebbug valley, which also yielded a curious double variety of *Bellis sylvestris* with green flowers. *Cyperus longus* was growing abundantly in a clover field near Musta on November 1st and two tiny plants of *Hedysarum coronarium* had struggled into flower in the same field. *Fedia cornucopia*, which ordinarily does not flower till January was found on the 7th November, affording further evidence of the forwardness of plants this season, due, no doubt, to the early rains. On the same day *Andrachne telephioides*, a pretty little plant with tiny monoecious flowers, was found growing on a heap of stones. It seems to be very rare in Malta. *Sueda maritima*, *Atriplex hastata*, *crithmum maritimum*, two sea-lavenders, (*Statice bellidifolia* and *G. dyethioclada*) were found on rocks by the sea, whilst strange to say, a few lingerers from the summer were gathered in the shape of the beautiful yellow flowers of the horned poppy, *Glaucium luteum*, a plant which is extremely abundant in some localities.

NOTES AND NEWS.

The tomato-crops of last season, in the Maltese Islands, suffered severely from the fungus *Phytophthora infestans*, the *peronospora* of the potato. It is, however, a remarkable fact that earwigs, caterpillars, aphides, snails, and slugs always carefully avoid this plant.

A very violent shock of earthquake is reported to have occurred at Biancaavilla, Sicily, on the morning of the 23rd inst.

A novel industry has been started in Paris says *Le Progres Medical*, consisting of the transformation of ordinary oranges into the more marketable varieties known as blood oranges. This is done by injecting into them Biebrich's scarlet, or rocelline, a harmless agent obtained from diazobenzol in a solution of B. naphthol.

We desire to acknowledge the receipt of the "Actes de la Sociétés Scientifique du Chili" Tome II, 1892.

An international Medical Congress is to meet at Rome next year, which it is announced the King of Italy will open in person.

The Malta Council of Government has sanctioned the adoption of the measures which were proposed by the Vine Disease Commission in August last.

Active steps are to be at once taken to prevent the spread of the baneful disease which so seriously affected the wine industry of the islands last season. It has been estimated that there are at the present time about one million vines in Malta and Gozo, and the cost of an effective treatment will be less than one grain per vine. (One twelfth of a penny).

In a short article which appeared in our last issue reference was made to certain experiments that had been tried in France, Italy, England and America for the purpose of determining an effective remedy for the potato disease (*Phytophthora infestans*), and at the same time a recommendation was made to the Maltese potato growers to give the matter their serious attention.

How far this warning was justified, is now being markedly demonstrated, for judging from the present condition of the potato crops in the island it seems probable that this seasons yield will be an almost total failure.

Any hint that may have for its purpose the freeing of our houses from that insufferable pest the mosquito will be gladly welcomed by our readers. It is well known that mosquitoes in common with any other kids of insects deposit their eggs in water and therefore wherever there are water receptacles there, the mosquito will increase and multiply. A simple remedy to prevent this has been lately suggested by a correspondent from Bangkok in Siam. It consists in making a couple of wrought iron nails red hot and dropping them into the water which it is desired to keep clear.

A petition is to be presented to H. E. the Governor of Malta praying that some restrictions

should be made for the more effectual protection of the islands fisheries. At the present time considerable latitude is allowed both as regards the methods that are practiced, and the times at which the fishing is carried on. This is not as it should be. No other food supply can take the place of fish; and the fisheries of the islands under adequate protection and judicious management will always be an unfailing and increasing source of wealth. It is to be hoped, therefore, that H. E. will think fit either to directly sanction the more reasonable of the restrictions proposed, or to appoint a special commission to inquire into the merits of the question.

The ninth member of "*Natural Science*" has been issued. Among the numerous articles which it contains we especially note. "The Evolution of consciousness" by Prof. C. L. Morgan. "Præmœval Man" by W. G. Smith, F.L.S., "The Evolution of Sharks' Teeth" by A. S. Woodward, F.L.S., "The Walk of Anthropods" by G. H. Carpenter, B.Sc., "The Falling of Leaves" A. B. Rendle, F.L.S., "Norwich Museum" H. Woodward, LL.D., F.R.S.

A paper on "The Marl Beds of the Maltese Islands by Mr. John H. Cooke F. G. S. was read on the 23rd of last month, before the Geological Society. The suite of Maltese Marl fossils which Mr. Cooke collected and which Professor G. Capellini and Dr. Simonelli of Bologna assisted in determining, is the most complete set that has ever been got together. The paper will appear in these columns at an early date.

The old biological station which was started at Cette eleven years ago under the auspices of the University of Montpellier is to be replaced by new and spacious buildings, the laboratories of which are already far advanced in construction. Considering the suitability of the Maltese Islands for the study of the marine biology of the Mediterranean, it is much to be regretted that no similar institution has been established on their shores. The marine fauna and flora of Maltese waters offer themselves as a rich, and practically untouched, field of research the careful working out of which would be attended with scientific and economic results of the very greatest im-

portance. Here is an opportunity for our young graduates.

It is very gratifying to observe that the correspondence on "Birds and Insects" which has filled so many columns of the local press during the past few months is now beginning to bear good fruit.

We have received several communications from Maltese landowners telling us that they have issued imperative orders to their tenants not to net or allow others to net or shoot, the small birds found on their lands. This is a step in the right direction—but why do not these gentlemen follow it up by urging for legislative measures to put a stop to the wholesale "Bird Murder" which goes on in the Islands from the 1st of January to the 31st of December. Under the circumstances can it be wondered at that the Islands are over run with insect pests, or that the agriculturist finds himself in such straitened circumstances when rent day comes?

Correspondence.

BIRDS V. INSECTS.

Strada Forni, Valletta.
November 29th 1892.

Sir,

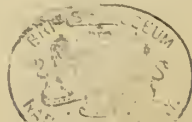
In a recent review of a report of the State Entomologist of the United States dept. of Agriculture the *Journal of Science* says: "Cotton, clover, grain, the vine, the orange, the sugar-cane, the potato, the cabbage,—all have their special enemies.

Fortunately they are to a certain extent kept under by insectivorous birds and other foes. Hence one of the most important duties of an agricultural entomologist is to warn the public against destroying their allies". (The italics are mine.) I would commend this passage to the attention of those gentlemen who have of late been opposing, in the columns of the local press, protective measures for the farmer's feathered allies. At the same time I would beg to suggest that it would be far more to the point if the statements made in your recent articles on the insect pests of the island, and the utility of certain species of birds in keeping their numbers down, were to be carefully studied and rationally sifted instead of being so arrogantly denied by those whom we have a right to expect should know better.

Yours truly
A. Jervis

Editor, J. H. Cooke, B.Sc., F.G.S., Malta.

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NOTICES.

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Contributors may have duplicate copies of their papers upon application to the Editor.

To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Communications for the Editor should be addressed to Highland House, St. Julians, Malta.

The attention of subscribers is invited to the notice on page 6 of the covers.

The Natural History of Certain Fevers occurring in the Mediterranean.

By SURG. CAPT. M. LOUIS HUGHES, A. M. S.

There is a branch of microscopical natural history which is day by day becoming of more and more practical importance to mankind and at which eminent scientists are hard at work all over the civilized world. I allude to the so-called science of bacteriology, a science so interesting to the biologist, for situated as it is on the border-land between the animal and vegetable kingdoms, its discoveries have helped to elucidate many of those difficult problems connected with the origin of life and species. By his discovery of the causes of fermentation and putrefaction, of silk-worm's disease and anthrax, Pasteur alone has added greatly to the wealth and prosperity of France. For the Physician this science has cleared up many moot points in the pathology of disease and to the Surgeon it has made possible many operations scarcely dreamt of before. It is however in the department of Public Health and Preventive medicine that this study may be said to be of vital importance, for it is by a scientific knowledge of this branch alone that we are able successfully to cope with those frightful diseases which as pandemics upset the commerce of continents, as severe epidemics have been known to decimate armies, and depopulate large tracts of country; which even in milder form not only cause great expense to governments and municipal bodies, but loss of life, labour and money to families and individuals.

Though Yellow Fever keeps away, and cholera but rarely visits us, yet here in the Mediterranean we have present at all times three common forms of fever, so closely allied that often they have been confounded with one another. Bacteriology has at last placed their specific nature beyond doubt and will help in the future, in preventing their

occurrence. The fevers I allude to are (a) *Enteric Fever* (Typhoid), (b) *Mediterranean Fever* (Rock or Malta Fever) and (c) *Ague* (intermittent, malarial or marsh fever).

Mediterranean Fever, so common in Malta affords an interesting clinical link between the other two, for in its severe forms it often closely simulates in its clinical characters, the appearances of Enteric Fever; while in its more chronic remittent and intermittent forms it has often been confounded with ague. To the various countries situated on the coasts of the Mediterranean, the prevalence of these fevers is of great moment, but to England it is of especial importance, for even if we omit the enormous yearly loss of life and money in the East and West Indies and in Africa, England has at present in the Mediterranean besides visitors and Mercantile interests, a force of some 24,000 soldiers and sailors, who are more or less permanently exposed to the effects of these fevers.

A Enteric Fever:—A bacillus first described in 1880 by Eberth and verified later by Kock, Gaffky and many others has been found to be present in the tissues of patients suffering from this disease, in such situations as the nature of the symptoms would point out. It is present in no other diseases and has now been accepted as the proximate cause of Enteric Fever, either itself causing the symptoms or doing so by means of products it may form. The Disease is believed not to exist among animals. These bacilli are rods 2 to 3 micrometres long and about three times less in breadth, with rounded ends, being found present in the human tissues, singly, in pairs and as small isolated deposits. In 1884 Gaffky succeeded in obtaining pure cultivations of this bacillus from man, growing them artificially outside the human body; and recently Peiffer has succeeded in isolating a similar bacillus from the stools of patients suffering from enteric fever. Their artificial cultivations on gelatine or agar appeared first as small citron coloured plates on the surface and in stab cultivations as a whitish thread along the needle-tract with a greyish-white flat layer on the surface. The surface plates on agar at the temperature of the blood become visible to the naked eye in about 20 hours and grow very rapidly as a flat greyish film, with an irregular, indented and even branched margin until finally they cover the

whole surface of the nutrient material, but without liquefying it. At the ordinary temperature sheets of potato inoculated with small quantities of bacillus typhosus appear almost completely unaltered after two or three days; at most the surface in the neighbourhood of the tract of the inoculation has acquired a somewhat moist and more shiny appearance. If we examine this more minutely we find the surface nearly covered with a skin formed of masses of these bacilli, and this peculiar mode of growth on potatoes is characteristic of this variety of bacillus.

The bacillus will grow, with or without oxygen in fairly alkaline media and in meat infusions, milk, vegetable infusions, tap-water &c. In a dried state they can live for over 3 months and in fluids for a much longer period. They have been found present so far in all fatal cases experimented on in Malta.

From the above facts and strong circumstantial evidence principally of a sanitary nature, it is believed that that this living infective agent, passing from the body by way of the faeces, infects linen, soil, or by means of defective drains food water air, and so may again enter the body by way of the intestine and set up in another man a similar form of fever.

Thus a defective drain pipe may infect a water supply and so infect milk, either when used for washing cans or when added fraudulently and has also similarly infected other food such as ice-creams, aerated-waters &c. The same drain may if defective infect the soil under a house, and bacilli may be drawn up from the soil into the house by currents of air, or straight from the drain as sewer gas. Enteric fever is also common here in Malta when the first heavy rains are washing the accumulated filth of the summer from the surface of the soil and streets into the wells and tanks and also from the roof where drain ventilators have constantly been discharging sewer gas. Improved drainage and water supply have done much to banish this disease from certain parts of Malta and it hoped that in time this good work will be extended to the whole of this thickly populated island.

(to be continued)

On the Miocene Beds of Western Algeria.

BY

Prof. JULES WELSCH.

The Miocene stages are to be seen in the normal order of succession near Hamman Rira, a department of Algeria, where they are superimposed on the Cretaceous. The following order may there be observed, commencing from the base:—

I. LOWER MIOCENE (*Miocène inférieur*).—Conglomerates and limestones from the Djebel Dienansolla to the bridge of Djer chez Granger, surmounted by grey marls.

These I refer to the Langhien stage, or *Miocène inférieur* as it is now called.

II. MIDDLE MIOCENE. This is made up of two formations the lower of which consists of sandstones, and limestones containing *Lithothamnium*, *Heterostegines*, and numerous *Clypeasters*.

It is a sub-corralline formation, of very variable thickness sometimes thinning out to a few meters as at Moula where I found a rich bed of *Clypeasters* of the Middle Miocene. The second stratum is formed of blue and grey argillaceous clays which attain several hundreds of meters in thickness in the Bon Allouance. In its upper part intercalated deposits of sands and sandstones occur, containing typical *Ostrea crassissima*.

These two beds represent the Helvetian stage of European geologists.

III. UPPER MIOCENE. This is represented by sandstones and yellow sands overlaid by pebble beds from Gontas to Chelif. This I shall show further on is the Tortonian stage.

In following the coast of this Miocene area to the west of Hamman Rira in the direction of Adèleia and Miliana the lower stages (Langhien) are to be seen passing laterally into pebble beds and sandstones of a peculiar greenish brown colour and having a remarkable sandstone facies. This has been called the *étage cartennien* by M. Pomal. I have found a somewhat large variety of *Ostrea crassissima* in it, on the old telegraph road to Adèleia. It is identical with the specimens that I have found in the Helvetian stage. I may add that the characteristic features of the Cartennien

stage are often found developed in the Middle Helvetian.

To the east of the Hamman Rira basin a similar change of the general facies of the rocks of the mountains of Soumata and of Mouzaia is also noticeable. On the road to the Mouzaia Pass beyond Ain Ismat the Langhien and Helvetian beds are also to be seen. The Helvetian often lies immediately on the more ancient strata, and in this case the lower bed containing the *Clypeasters* is after found to be no more than one meter in thickness, and sometimes it is entirely wanting. If these strata be followed to the west of Algeria, to the north of the lofty mountains of Ouarsensis and through the valley of Chelif, they will be found to be fossiliferous to the north of Carnot and towards Beni Rached.

The sections in the Boukali basin exhibit the following order.

2. The Helvetian stage is frequently found resting upon the Cretaceous, and includes very thick grey clays, and many sandstones.

Facilities for the study of these are offered along the new road to Damous.

3. Above these are found sandy clays, containing Tortonian fossils: *Aacillaria glandiformis*, *Turritella valriacensis*, and numerous varieties, *Turritella archimedis*, *Pleurotoma ramosa*, *Pleurotoma cataphracta*, *Cardita Jonanneti*, *Arca diluvii*, etc. etc.

These fossil beds are overlain by sands and yellow sandstones, and by pebble beds which mark the limits of the Upper Miocene. I did not find any fossils there.

III. If the Miocene Beds be traced through the province of Oran from the southern side of Ouarsensis towards Tiaret and Mascara, the the Helvetian strata will be often be found resting directly upon Jurassic and Cretaceous formations.

Near Mascara a similar order of succession to that which I have just mentioned may be observed.

2. At the base in the ravines of Sidi Amar, to the the right of the road leading to Oran near 91st milestone, beds of the and coarse sandstones pebbles are to be seen which probably represent the Lower Helvetian. The Helvetian is generally

represented by grey, and blue clays, specimens of which may be observed in Beni Chougrau.

3. The Tortonian stage comprises a series of of argillaceous sands with *Ancillaria glandiformis*, *Phos polygonum*, *Turritella patriacensis* and numerous varieties, *Turritella Archimedis* *Natica millepunctata*, *Nassa semistrata*, etc., etc.

Above these the yellow sands and pebbles come next, and enter largely into the composition of the hill of Chareb er Riha, and form the upper boundary of the Upper Miocene.

IV. The general results are:—

1. The faunas of Mascara, and of Beni Rached and Carnot are identical. They do not belong to different stages, as has been published.
2. The last elevation of the Atlas did not take place at the end of the Helvetian epoch (Middle Miocene) as has up to the present been believed. It is Post Tortonian and took place at the end of the Upper Miocene period, as the beds of Gontas, of Ben Chicas, of Teniet, and of Mascara are Tortonian.

Poitiers.

A ramble through Emtahleb.

Often when rambling through the rocky gorges and beneath the craggy escarpments of these islands, my attention has been drawn to the silent though effective manner in which the humblest agents in the economy of nature have their powers directed and husbanded, in order that the greatest effect might be produced with the least expenditure of energy. How many would imagine that the same plant life which clothes the hills, valleys, and plains on the islands' surfaces, and which imparts such a charm to what would otherwise be all that is sterile and desolate, is one of the most unremitting of the many agencies that are at work in degrading down the rocks of which they are composed?

Year after year it plays its part, unobtrusively it is true, but so sure and certain that as ages elapse the most stupendous changes are wrought in the contour of the islands' surface.

Measured by human experience, the changes are slow, and are but of little importance. The short span of existence allotted to man is not sufficient to allow him to appreciate their full significance, unless he can look back into the past and, using his own experience as an index can consider the aggregated changes that have been effected through the instrumentality of apparently such insignificant causes. If he is prepared to do this he may arrive not only at an approximation of the condition of things that formerly existed, but he may also obtain some idea of the nature of those forces that are constantly engaged in the work of destruction.

There is no spot in the two islands that will afford more genuine pleasure to the lover of Nature than will the charmingly situated valley of Emtahleb, with its rippling, purling streams and verdure-covered slopes; and that will, at the same time, afford more excellent opportunities for examining closely the conditions under which the plant life of the caves and gorges exists, and the part it plays both in protecting and destroying the rock surfaces upon which it grows.

Innumerable opportunities will present themselves to enable one to observe the shifts to which the larger trees resort in their struggle for existence. The rich though scanty soil that covers the slopes is not of sufficient depth to enable them to obtain that hold in it that their great size demands, and they therefore insert their roots into the cracks and crevices of the strata and then, as in course of time, the increased bulk of the underground branches necessitates more space than the confined limits of the place will allow, the rock is shattered into fragments as effectively as though it had been subjected to the blows of a Brabdingnagian hammer.

Descending the tortuous path which leads to the springs at the bottom of the valley, an excellent example of the manner in which even a single tree may alter the physical aspect of the country in its immediate vicinity, is to be seen on the top of the cliffs that fringe its northern side.

The gaunt, spectral trunk of an old carob tree overhangs the beetling brows of the rugged limestone cliffs, and seems to invite inquiry into the manner in which it has attained its strange position.

It tells its own tale readily enough, and almost seems to be proud of the work of destruction in which it has been concerned, and which ultimately brought about its own ruin. In a fissure of the Upper Limestone, a deposit which forms the capping of all of the hills in Gozo and Malta, it had, in bygone years, taken root; and had disseminated a perfect network of tough fibrous tendrils throughout every available nook and cranny.

In the meantime, the subjacent Sand and Clay beds had been slowly eroded away by the atmospheric agencies that had been constantly assailing them, and thus the Upper Limestone masses, having been deprived of their foundations, were left in a state of unstable equilibrium, which rendered them susceptible of the least mechanical strain, whether exerted from above or below.

The end soon came. Many of the rootlets had decayed, and becoming intermixed with other vegetable matter that had entered the fissure with the rain, a humus had formed, from which carbonic acid gas was evolved; this, acting on the limestone caused an enlargement of the fissure, and the mass of rock thus attacked and weakened in every direction, at length broke off from the parent bed, and thundered down the slopes to the bottom of the valley. The tree was reft in twain by the force of the separation; and now gaunt and bare, its mutilated trunk sways to and fro with every breeze, as though moaning over the fate that had deprived it of its erstwhile home.

"Cast anchor in the rifted rock,
And o'er the giddy chasm flung
His shattered trunk, and frequent flung,
Where seemed the cliffs to meet on high,
His bows athwart the narrowed sky."

Among the multiplicity of causes at work, hollowing and scooping out the caves that occur so plentifully all along the escarped sides of the valley, none are more indefatigable in their exertions to forward the work of destruction than the innocent-looking, sweet-smelling mint (*Melissa officinalis*), and the delicately-formed maiden-hair ferns, with which the walls and floors of the caverns are often draped. Carefully remove two or three of these plants from their places, and note how they have converted the upper film of the rock itself into a soil wherewith to assist them in their

struggle for existence. Yonder wall, with its rich green mantle of ivy, deserves, too, a share of attention. How the tendrils of this hardy little creeper have inserted themselves into the most impossible of places, and have threaded and rethreaded the interstices until they have bound the whole mass as no mortar could have done it; but let us lift this grey, green garb and expose the rottenness that exists beneath. The stones appear to be in a rapid state of decay, owing to the humid nature of their surroundings, a state which is clearly attributable to the plant-life that covers them, for see, those very parts that are not so covered, have successfully withstood all the combined attacks of the atmospheric forces to which they have been subjected.

But of all of the plants that contribute towards this wasting away of the island deposits, the cactus or prickly-pear stands pre-eminently the first, as being the one to which the most mischief is due.

This plant is extremely hardy, and grows in great abundance, anywhere and everywhere in the islands. No soil seems to be too poor for it to take root in; and as soon as one of its oval, fleshy leaves is set, in the course of a comparatively short space of time a small forest of them may be anticipated. It often attains a considerable size, ranging from one to fifteen feet in height, and the fruit, which is of a rich, red and yellow colour, is used by the peasantry as food, both for themselves and for their cattle. Like all other trees of vigorous growth, it does not confine itself to the soil, but causes its roots to ramify in all directions; and wherever it is possible it penetrates the underlying strata in search of those phosphates and carbonates that are necessary to its existence, and in which the soil may be deficient.

But the work of breaking up the rocks and converting them into soil represents only a very small proportion of the actual part which it plays as an agent of degradation.

The humus, formed by its decaying portions evolves large quantities of carbonic acid gas, or carbonic dioxide, and this, when dissolved imparts to the water some peculiarly destructive properties.

Pure rain-water, when alone, has but little effect upon lime; but, in conjunction with this gas, its dissolving powers are increased fifty-fold.

The rain-water that descends upon this decaying mass of vegetable matter, saturates itself with the

carbonic dioxide, and then percolating through the limestone, it dissolves and carries away in solution the carbonate of lime of which it is largely composed. Evaporation follows, and by means of another chemical change this lime is again deposited as an insoluble substance, known to chemists as bi-carbonate of lime.

In this way vast caverns are formed in the very bowels of the earth, and many of them are draped and festooned in a most fantastic manner, with stalactites and stalagmites that have been deposited after the evaporation of the water, which has done the work of excavation.

The "Ta Ninu" cavern on the "Ta Xaghra" hill at Gozo, and the stalagmitic cavern, popularly known as "Calypso's Grotto," in which the lovestricken goddess is said to have held her court, and to have entertained Telemachus after his shipwreck, may be cited as examples of the magnitude of the work effected through the instrumentality of objects apparently so trivial and insignificant.

But let us descend the terraced sides of the valley, passing *en route* the gnarled and twisted trunks of numerous carob trees, pomegranates, German medlars, wild plum trees, orange trees, silken-rye grass, and the host of other trees and plants with which the well-tilled slopes of this fertile spot abounds, and wend our way onward to the little springs whose rippling music had attracted our attention when standing on the heights above. What a blending of rural rusticity and wild rugged grandeur do we not here find? Immediately around us, the springs ripple and dance onwards amid a wealth of verdant watercresses and sweetly-scented wild flowers; while in the background loom up dark and gray the craggy heights of the Binjemmas, the brilliantly white limestones and the rich warm colouring of the marl-beds of which lend an effect of beautiful and substantial magnificence to the scenery.

But do our charges against the plant world of the islands rest here? Assuredly not. Let us examine the banks of the streamlets whose water are eddying onwards through their marly channels, and we shall find numerous fresh instances wherewith to implicate them. Several of the trees that are growing on the banks have been so vigorous in their exertions to drive their roots in the direction of the water that they have undermined a neighbouring wall,

and have caused their roots to appear in the very bed of the brook. This action has loosened the soil in the vicinity, and while in that state, considerable quantities have been carried onward by the current and washed into the sea.

This is example, on a small scale, of what is happening to the banks of rivers in other countries, on a scale of, considerable magnitude.

The undermining action of the waters is facilitated by the preparation made for it by the roots of the trees that grow on the banks: and when as often occurs, the trees themselves are precipitated into the flood, either by the force of the gale or by being themselves undermined, they carry with them tons of soil, and thus open up inequalities, that can only be effaced by a considerable lateral extension of the stream itself.

A walk in any direction along the southern coast of the islands will furnish us with endless examples of the various ways in which "plant life" assists in degrading rock surfaces when the conditions are favourable. The southern slopes are strewn with boulders that have broken off from the Upper Limestone, and have rolled down the hillsides, thus suggesting, from their great numbers and huge proportions, the idea of a vast labyrinth of Cyclopean anarchy.

And yet nothing more terrible has caused this destruction than the ceaseless attacks of those atmospheric agencies, which by eroding the subjacent Sand and Marl beds, have caused the superincumbent limestone to break off and precipitate itself down the slopes.

Though this work is largely due to the combined action of a variety of aerial agencies, yet even here the humus of decaying vegetable matter plays its part and adds its quota in assisting in the work of devastation.

The weatherworn and fretted appearance which is the chief characteristic of the surface of the south eastern portions of both islands may in like manner be attributed to these causes.

These extravasations on the rock surface are the means whereby, in winter time, a certain charm is imparted to these otherwise rugged and sterile portions of the islands, for the potholes then serve as so many natural flower pots in which luxuriates a wealth of verdure; but this state of things endures only for a few months, for when summer

returns, plant life disappears, and once again the island dons that sterile, desolate garb which has earned for her such an unenviable reputation. But these periodical alternations have not been effected without leaving behind them some traces of their existence. This annual decay must be, and is followed by its usual physical accompaniments, namely, the disintegration of the surface upon which the plants have rested, and thus new surface indentations are formed and old ones are, by the latest operation, still further enlarged,

I do not say that this is the only cause to which these surface excavations are due, but it, at least seems to me to be the principal one.

From the preceding observations it will be seen that I have considered the effects wrought by one only of the numerous class of agents that are constantly engaged in wearing down the surfaces of the islands strata.

It is, however, one the importance of which is not always so fully appreciated as it should be, for though it works as effectively as the others, yet by reason of its subtle methods, and the fact, that under certain conditions it exerts directly opposite effects, it does not always get the full credit for the work that it is actually responsible for.

J. H. C.

The Flora of Northern Germany during the Middle Ages.

We extract the following notes from an interesting paper by Dr. E.H.L. Krause on the Flora of Northern Germany in the Middle Ages, which appears, with a map, in the current number of 'Petermann's Mittheilungen.' The author deals mainly with the period from the twelfth to the beginning of the sixteenth century—the materials relating to earlier periods being very scanty—and concerns himself only with the vegetation of uncultivated lands. North-west Germany was in the Middle Ages rich in forests. In Saxony there was less forest in the sixteenth century than the twelfth to the fifteenth centuries. In Oldenburg to-day there are oaks and beeches estimated to be over 500 years old, notably in the so-called virgin forest

of the Varel district. The general character of the forests of Schleswig-Holstein in the Middle Ages was deciduous, with a predominance of oaks and beeches, pines being absent. The West Baltic coast was from the eighth till the twelfth century little inhabited, and remained thickly wooded, the forests being much less broken up by heaths and moors than those of North-west Germany. The central mountains of Western Germany were also well covered with forests. The heights in the basin of the Moselle, which had been cleared of trees by the Romans, were, shortly after the occupation of the country by the Franks, again clothed with forests. Turning to the three central provinces of Thuringia, we find that the heights to the north and south of the Harz Mountains were wooded, and besides oaks and beeches, aspens and birches were very common. The flora of the Sarmatian lowlands stood in striking contrast to that of the western provinces. In the former, pinewoods were everywhere abundant, the Scotch pine being in many places the most common tree. In this region the western limit of the pine forests appears to have been in some measure coincident with the boundary between the Slav and Low German populations. On the East Baltic coasts the red pine was more common, and beeches almost entirely disappeared. The higher mountain ranges were characterised by the presence on their lower slopes of the silver-leaved fir. This tree has completely disappeared in the Harz Mountains. It is doubtful whether this species of fir flourished in the highlands of Poland in the Middle Ages. Dr. Krause's paper forms a valuable contribution to the historical study of the geographical distribution of plants, and his map is carefully worked out.

Journ R. G. S.

SCIENCE ECHOES.

Phenomena of a British Coal Mine.—A newly opened coal-mine near Manchester, Eng., lies at the great depth of about 1900 yards, and the boring presents the curious phenomenon of passing down from one seam of coal to another one 400 yards geologically higher. This is due to a rever-

sed fault, by which the seams are thrown into this remarkable relative position. At the bottom of the mine the temperature is 84° Fahr., which is unexpectedly low, and the barometer stands three inches higher than at the surface.

Electric Rain.—Sparks from rain-drops are rare but were witnessed a short time ago by an electrician at Cordova, Spain. In the evening of a warm day, dark clouds arose, and at about eight o'clock there came a flash of lightning, which was immediately followed by great drops of highly-electrified rain, each of which gave a crackling sound and emitted a flash on striking the ground or other object. This sparking rain lasted several seconds.

Poison from Eggs.—A poisonous substance has been obtained by Prof. Max Gruber, of Vienna, from the albumen of fresh hen's eggs. The egg albumen is shaken with pure water, then treated with water absolute alcohol, and the precipitate treated with water for some time. This yields a yellowish alkaline solution, which has a curare-like effect when injected into animals. The poison seems to be an albuminous body resembling some of the snake poisons, and it loses its power after a few days exposure to air and light. The solution is coagulated by cooking only when it has become several days old.

Intermittent Lakes.—A remarkable hollow in the midst of the hills near Koberbrun in Silesia, contains about 2600 acres, and is filled with water and emptied in quite regular periods of somewhat less than thirty years. It is almost perfectly dry for a brief season. Water then oozes in through the ground, and gradually rises in the basin, which is now half full and still filling. The lakes slowly recede and, in about twelve years, entirely disappear for a short time. No other lake of regular increase and decrease in a period of many years seems to be known, although there are others that occasionally become dry.

Archaeological Streets.—The soil of Rome is a mine of wealth for the museum collector. Counting only objects of some value the following astonishing yield was obtained in the excavations for the 82 miles of new streets made last year: 905 amphorae, 2360 terra cotta lamps, 1824 inscription on marble, 77 columns of rare marble, 313 pieces of columns, 157 marble capitals, 118 bases, 500 intaglios and cameos, 18 marble sarcophagi, 152 bas-reliefs, 192 marble statues, 21 marble animals, 266 busts and heads, 54 pictures in polychrome mosaic, 47 objects of gold and 39 of silver, and 36,679 coins.

The Problem of Origins.—"Whether it is possible," remarked Prof. Max Muller at the International Oriental Congress, "to account for the origin of languages or rather of human speech in general is a question which scholars eschew, because it is one to be handled by philosophers rather than by students of language. I must confess, the deeper we delve the further the solution of the problem seems to recede from our grasp: and we may here too, learn the old lesson that our mind was not made to grasp beginnings. We know the beginnings of nothing in this world, and the problem of the origin of language, which is but another name for the origin of thought, evades our comprehension quite as much as that of the origin of our planet and of the life upon it, or the origin of space and time, whether without or within us. History can dig very deep, but, like the shafts of our mines, it is always arrested before it has reached the very lowest stratum."

Cancer in Fish.—In recent years cancer has been quite frequently observed in the lower animals, proving to be by no means so rare among them as was formerly supposed. But what is probably the first known occurrence of the disease in fish has just been recorded by a New Zealand naturalist, Prof. Scott. The victims were all American brook trout kept in confinement in one of the ponds of the Dunedin Acclimatization Society. Both males and females were affected, and the diseased fish never recovered.

From Rock to Plant Food.—The process of conversion of granite into soil is thus summarized by Prof. A. Johnstone, of Edinburgh: Oxidation of iron is the first change perceivable; then creation and multiplication of weather joints, and carbonation follows; next humus is formed by lichens and then higher plants; following this, fungoid germs, capable of assimilating aerial nitrogen, became abundant; finally all the three processes, mechanical, chemical, and organic, go merrily on together and contribute all in their proper shares to the formation of an ever-deepening soil capable of supporting the luxuriant life of the highest plants.

Romance of Scotch Science.—The development of Scotland's shale oil industry was mentioned in the president's address to the late meeting in Edinburgh of the British Pharmaceutical Conference. A few years ago the shale was looked upon as useless. From it are now obtained paraffin, lubricating and burning oils, and ammonia, more than £3,000,000 of capital being invested. Last year 55,000,000 gallons of crude oil were distilled from 2,311,592 tons of shale. A curious incident in connection with this industry is that the designing of the machinery for condensing the shale vapours led to the production of the world-famous refrigerator—the Bell-Coleman—by which the great ocean trade in frozen meats has been made possible.

An Australian Remedy.—A very simple treatment of snake bites is said to be applied by the natives in Australia with uniform success. A piece of human hair string is tied tightly three or four inches above the bite, a small circle an eighth of an inch deep is cut around the two fang punctures with a sharp stone knife, and the largest vein below the bite is slit to allow the blood to run out. A stream of water is turned on the affected part, and the limb is rubbed down steadily for about twenty minutes. When every drop of blood seems to have been passed out of this part of the body the slit vein is twitched up with a piece of sharp thin wood, dirt is applied to the wound, and the string is removed.

Electric Heat for Plants.—For a number of years, experiments with the electric light and the electric current in forcing vegetables have attracted considerable attention, but electric heating for conservatories, the idea of two Swiss electricians, seems to be a novelty—in practice, at least. It gives promise of good results wherever, as in Switzerland, cheap motive power may be had. A dynamo sends the current into receivers of special metallic composition, which became rapidly heated to a certain temperature, but not beyond, and gives forth the heat like steam-radiators. Important advantages are claimed. The apparatus is very simple and cleanly, injurious gases are avoided, and the heat can be regulated at will without risk of fire and turned on or shut off very readily.

How the Coal is Burning.—A statistician has attempted to determine approximately the world's consumption of coal. He estimates that in generating steam for engines aggregating 10,000,000 horse power (some authors rate the world's engines as high as 20,000,000 horse power) coal is burned to the amount of about 12,000 tons per hour. For gas for lighting, the consumption is not less than 10,000 tons per hour; and for gas for heating and motive power, probably 4,500 tons. In metallurgy the use of coal reaches about 9,000 tons per hour; and in workshops and factories, 5,000 tons. It is difficult to calculate the quantity employed for domestic purposes, but 55,000 tons per hour, or 1,320,000 tons per day of twenty-four hours, seems to be an under-estimate. Placing the actual daily consumption for the entire world as low as 1,600,000 tons, we find that a solid cube of coal more than 100 yards on a side is burned up every day.

A Lake of Ink.—Near the eastern end of the remarkable volcanic area of Arizona is a little lake of ink black water. It is about a quarter of a mile long and half as wide, and is fed by numerous little streams—some hot, some warm, and one or two cold—whose waters are strongly charged with different acid and alkaline salts. The water of the lake feels smooth and oily, and its taste is salt and

bitter. Its temperature ranges from 110° near the shore to 156° on the surface at the centre and 216° at a depth of 250 feet. Though the water is jet black, it does not stain the skin of bathers, but the minute solid particles it holds in suspension adhere to and colour the fibres of white cloth. The lake—a bath in which is wonderfully exhilarating—has long been famous among the Indians as a place of cure for all forms of disease.

Great Icebergs.—At certain seasons of the year as is well known, the Atlantic route to Europe is crossed by great processions of icebergs. These were especially numerous in 1890, and one that was passed on July 10, in 49° N., 24° W., is believed to have made the nearest approach to British shores of any iceberg since the glacial period. Fewer icebergs than usual were seen in May and June of this year. They were however, reported to Washington by 250 vessels; and one of them—seen from a German vessel, in 46° N., 47° W.,—was 600 feet high and 4 miles long! In the Antarctic waters this seems to have been a maximum year of floating ice. There the icebergs are always more numerous and formidable than in the north yet it is not often that navigators have the experience of an Aberdeen captain, who about the middle of May, in 45° S., 25° W., narrowly escaped running into an iceberg 1000 feet high, and the next day sailed along an immense ice island 800 to 1000 feet high for a distance of 40 miles. From other vessels extraordinary reports have been made. Ice islands of similar vastness have not been unknown in former years, as from December 1854, to April, 1855, no less than 21 vessels passed in 40° and 20° W., a horse-shoe shaped mass of ice 60 miles long and 300 feet high, the arms of which enclosed a sheltered bay 40 miles across. A height of 1000 feet—which can better be appreciated when it is remembered that only about an eighth of the mass of floating ice projects above the water's surface—has been several times reported.

A New Form of Carbon.—It is generally known that carbon, one of the most important of the elements and a necessary constituent of every living thing, exists as an element in three allotropic forms—the diamond, graphite, and charcoal or

soot—having widely different properties. A new variety, differing somewhat from graphite, has recently been obtained by Lazi. When a piece of porcelain is heated in a blast furnace to about the melting point of platinum, and the access of air is cut off, the highly-heated porcelain is surrounded by a smoky flame, and in ten or fifteen minutes becomes covered with a peculiar deposit of carbon. If the porcelain is unglazed, the deposit resembles graphite. If glazed, the deposited carbon is bright and silvery and has a metallic lustre, some portions adhering firmly, others cleaving off readily and curling into exceedingly light rolls, which resemble metal shavings and stick to the fingers like silver-leaf. This form of carbon is free from ash, and does not give the nitric acid reaction for graphite. Moreover, it is also absolutely opaque. The same chemist has found that natural graphite gives the nitric acid reaction in about half of the specimens examined, and he regards these as graphite proper separating the others into a new class which he calls graphitite. On heating, the diamond falls into a powder which resembles graphite, but which does not give the nitric acid reaction.

Distribution of Spiders.—Recent catalogues show that entomologists have found 233 species of spiders in the Upper Cayuga Lake Basin, 370 in the District of Columbia, and 340 in New England. Dr. George Marx has compiled a list of 202 species which have been found in the polar regions of the globe, and after much study has reached these conclusions:

1. The Arctic spider fauna is composed of the ten families which we may term the common ones their species constituting the main bulk of the entire spider fauna of the world. They are cosmopolitan, and are found almost wherever animal life is possible.

2. The genera of the Arctic spider fauna are, without exception, those which also occur in other regions of the world, and there has been found so far not one genus which is original to that zone of eternal ice and snow. This is a very remarkable fact, since in all other Arthropod orders, and those of higher rank, the polar fauna is distinguished by special and peculiar forms.

3. Even among this species a vast number occur which live in milder climates and under entirely different conditions and influences and we find some families represented by only such forms, lacking entirely original Arctic species.

4. The differences between the faunas of the Eastern and Western Hemispheres are slight, and generally speaking, those forms which are most frequently represented in one are found in the larger proportion in the other.

The Relationship of the Structure of Rocks to the conditions of their Formation.

By H. J. JOHNSTON LAIS, M.D., F.G.S., ETC.

Amphibole.—This mineral has baffled all the attempts of the chemist to prepare it artificially otherwise than as a solidation. Whenever its elements were fused separately, or a complex mixture, was fused, the only product was its ally—pyroxene. Our entire acquaintance with amphibole indicates it as a mineral crystallized under pressure, and probably from an aqueiferous magma. Its continual occurrence in syenites and allied rocks show it to be easily crystallizable under the conditions which these rocks came into existence. I have found it in basic pumice continually accompanying orthoclase (of which we shall speak next) in the more vitreous and early stage of the explosive eruption ejections of Vesuvius, Roccamonfina, &c. In the later stages of the same eruption it does not appear to have increased in size or abundance, whilst it is often enveloped in pyroxene; and this latter species is spread throughout the mass, increasing in proportion as the rock approaches the lava type. This is the more remarkable, because we know that amphibole is more fusible than pyroxene; whereas, if we exclude change of pressure, &c., it should have crystallized later. This fact alone is quite sufficient to disprove any relationship between the fusing-point of a mineral and its order of crystallization. Where amphibole is found in a lava, we have evidence that it existed as such before the eruption of that

material. It is not at all an uncommon mineral lining vesicular cavities; but it there shows itself to have been deposited by sublimation, which is borne out by its discovery under similar conditions in some furnace scorias. (1)

Orthoclasic felspar was obtained by M. Stanislas Meunier (2) by fusion and subsequent *recuit* of acid rocks. The product, however, only consisted of crystalline concretions, having the composition of orthoclase. Microliths only rewarded the efforts of Messrs. Fouqu  and M. L vy (3) after a long *recuit* of eight days. These facts are thoroughly borne out by the basic pumices. Those that were cooled very rapidly in the first eruptive stage exhibit large, well-formed crystals of sanidine associated with amphibole, showing the similar conditions under which the two minerals were formed. (4) In the latter stage of these eruptions the large crystals have not increased in number or size (?); but from the slower cooling a few microliths have formed. Another proof is to be found in the occurrence of fragments of a porphyritic rock, which is only the pumice magma that, in some outlying fissure, has cooled under pressure, and in some cases undergone secondary alteration. This shows the sanidine crystals still larger and more perfect. This rock may be traced by gradations to a syenite-like rock, in which the amorphous magma is entirely converted into *formed* matter. In the basic lavas, which are identical in composition with the above pumices, the sanidine only occurs as very small crystals or microliths, as the magma rising quickly to the surface has little time to partially crystallize under pressure. On the contrary, after extrusion, the lava will cool very much slower than the pumice, so that the prolonged *recuit* will be highly favourable to development of orthoclase microliths, and even small crystals. These facts are well borne out by Vesuvius in its pumices and modern lavas, whilst the outflows *Phase IV*., following immediately on a pumiceous phase, hold an intermediate place with regard to their monoclinic felspars. It is not an uncommon thing in

(1) *M.L. Bourgeois, Op. cit., p. 119.*

(2) *Comptes rendus, 1880, t. xc., p. 1009.*

(3) *Comptes rendus, 1878, t. lxxxvii., p. 700.*

(4) *Whether these are really orthoclasic is generally a very difficult matter to determine.*

basic pumices to find sanidine (1) crystals eroded, enclosed in others, which in turn may exhibit eroded surfaces, and again be enclosed in a third crystalline shell with well-defined facets. The orientation of each crystal being different from that which it coats, or is covered by. It is evident, therefore, that this mineral must have undergone a series of vicissitudes which must have taken a far longer time than was occupied in the eruption and cooling of this product of an explosive eruption, and must have required more quietness than could occur in the expansion and ejection of pumice. This latter example I take to be an important argument in favour of the hydro-thermal, or plutonic, formation of ortho-clastic felspar in a magma cooling under great pressure. Another fact also of deep interest is the very extensive replacement of sanidine in the Vesuvian pumices of *Phases III. and IV.*, by leucite in those of *Phase VII.* and the lavas, as these are the two principal competitors for the potash. If the granite and syenites of the Val di Fassa, and the latter of Skye described by Scrope and Geikie respectively, are really subaerial expansions, which I doubt, we must suppose them to have been nearly completely crystallized before eruption. Porphyries, no doubt, are erupted granites, which had undergone much crystallization *before their extrusion*. Even in the most vitreous rocks, such as the obsidian and obsidian pumice of Lipari, where the latter, although, as a whole, a highly vitreous mass, contains, large crystals of sanidine scattered through its mass.

Triclinic felspars.—Other felspars, such as labradorite, were produced by a *recuit* of some days; but large crystals, such as are met with in the Etna lavas, do not so far seem to have been obtained. Such a result is easily explicable, when we are informed that to produce a microlith some days are require, whereas we know that even after the expulsion of the lavas of Etna many months or years are requisite for their cooling, so that *recuit* may be prolonged far beyond the limits within which we can experiment. If a large stream of lava, such as issued from Etna in 1669, be examined, it will be found that even that which was cooled

immediately, contains crystals of labradorite which indicate the plutonic origin of that mineral, or that the magma had been undergoing a prolonged *recuit* in the upper part of the chimney. Specimens taken from the centre of some of the thicker parts of the stream far from its source, and which must have been long in cooling, we find the crystals of that felspar therein contained have attained greater dimensions, thereby indicating that under favourable circumstances this mineral may undergo further growth after extrusion of the lava. A similar occurrence I have noticed at Vesuvius. At Cisterna is a gigantic lava stream that is known to be more than half a kilometer broad, and its depth beneath is unknown, although it is carried to a depth of twenty meters, at a distance of more than ten kilometers from the original eruptive axis of the mountain. Now, of all the lavas of Monte Somma this is the most extremely crystalline one, all its constituents being of very large size, and practically all the amorphous paste has passed into a crystalline condition. So far as is known, this is the greatest outpour that ever occurred from this mountain; and, no doubt, in consequence of its enormous thickness, being unrivalled by any modern stream, a very long time must have been occupied in its cooling, conditions highly favourable for the production of a coarse structure. When small streams dribble from the crater after prolonged strombolian action, the structure also is often very coarse, as the part of the lava column in the chimney has been gradually losing its heat. Anyone who visits Monte Somma may have noticed that most of the lavas along its crest are coarse-grained, whereas most of those near the toe are finegrained. The reason, as at present with Vesuvius, is obvious.

From the almost impossibility of artificially producing the felspars, Delesse, (1) Daubrèe, (2) and Sorby, (3) assert that they must be the result of hydrothermal origin. Whether the actual presence of water is necessary directly, or only as the

(1) Fouqué and L'ry, *Comptes rendus*, 1878, t. Lxxviii., p. 700.

(1) *Bull. Soc. Geol.*, 1877 and 1878, vol. cv., p. 728, 757, 769.

(2) *Rapport sur les progrès de la géologie expérimentale*, 1867, pp. 63 and 84.

(3) *Brit. Assoc. Reports*, 1880.

(1) H. J. J. L. "Geology of Mt. Somma and Vesuvius," &c. *Q.J.G.S.*, Jan., 1884, p. 71.

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means of increasing the tension and pressure in the magma, seems at present unanswerable.

Anorthite was the most easily obtained, and corresponded in characters exactly with the same mineral in lavas that have consolidated near the surface. This mineral, as is well known, is rarely met with in true plutonic rocks.

(to be continued.)

The Collection and Preparation of Foraminifera.

BY EDWARD HALKYARD, F.R.M.S.

I propose in the present paper to describe as far as I am able the various methods employed in the collection and preparation of sand and other deposits containing recent or fossil Foraminifera. The processes treated of will be chiefly those which I use myself in this work, but I may have occasion to mention, and in some cases quote, "in extenso," various authors who have written on this subject from time to time.

The apparatus required for the collection of shore-sand is very simple and inexpensive, consisting only of the following articles: a common iron spoon, a flat piece of tin turned up on three sides (the lid of a rectangular tin box with one end cut off being very suitable), and a few small brownholland bags to contain the gatherings. The spoon is used for the purpose of scraping up the Foraminifera from ripple-marks, the bottom of small pools, and other places where the sand is in a wet state. The tin plate will be found very useful for scraping a level surface at high-water mark where the sand is in a drier state. I have several times, by means of this instrument, secured an almost pure gathering in consequence of Foraminifera having dried sooner under a warm sun than the sand on which they were laid, the sand also being firmer and more compact than the lighter shells. Care must be taken not to scrape too deeply, for nothing except heavy bags will be gained by so doing, as the shells all lie upon the surface of the sand. I may here mention that I have found the time of low-water to be the best for collecting, as the sand is drier

from being exposed to the air some hours, and the material gathered not containing so much water is in a fitter state for carrying in the collecting-bags without parting with surplus water in the form of drippings which generally find their way on to the collector's clothes.

The "set" of the tide and contour of the shore ought to be observed, as these are important factors governing the place of deposit of the objects sought for. Shores where there are quantities of shingle at spring high-water mark ought to be visited if possible during neap tides, as there will generally be found a sandy lower shore, where the Foraminifera have a chance of being deposited by the retiring tide in a manner favorable for gathering. The collector ought not to neglect searching round the base of any large boulders, especially if there has not been any great "wash" about them. Zoophytes and small sea-weeds may also be examined, in order to obtain parasitic forms which may be adhering to them, it is best to carry this material home and look at it when dry, the sand which is shaken from it being also put on one side to be "floated" with the other gatherings. I have also obtained good and rare species of Foraminifera from the sand and mud adhering to molluscs, crustacea, etc., brought up by the trawlers, but it is only rarely that one is fortunate enough to come across a trawler who will take the trouble to save the rubbish from his trawl even though offered a good price for it.

Living Foraminifera may be found by washing in a fine muslin net the small sea-weeds and Zoophytes growing in low-tide pools. The manner of using the net is as follows: a quantity of weeds, etc., having been gathered, the net is immersed in a pool (care must, however, be taken that the upper edge of the net is kept above water), the weeds being washed one by one inside it, after this is done the contents of the net are turned into a large widemouthed bottle full of sea-water for examination on the return home. Of course many other organisms besides Foraminifera will be found in this gathering, such as Ostracoda, Entomostraca, Copepoda, and other small crustaceans, which do not make the work any the less interesting.

The Foraminifera ought to be picked out and put in sea-water in small bottles or tubes, when they will creep up the sides of the receptacles by

means of their pseudopodia, and I may be readily observed with a pocket-lens. They will often live in this manner for many weeks if kept in a cool place. Mr. J.D. Siddall in his report on the Foraminifera of the Liverpool Marine Biological Committee's District, writes as follows concerning the collection of living specimens: "I have obtained alive, and kept in bottles, and repeatedly examined specimens of most of the types of Foraminifera, enumerated in the following list," (namely, List of the Foraminifera of the L.M.B.C.'s District); "but these have invariably been got from the mud at the bottom of shore pools of greater or less depth. Under the influence of the sunlight, the Diatoms and other algae which grow in the mud at the bottom of such pools, often rise to the surface in patches. These act as rafts and carry the Rhizopoda up with them. Once up, the out-spread pseudopodia enable even the largest and heaviest forms got in our district to float perfectly. I have seen a shore-pool at Holywell covered quite thickly with *Polystomella striato-punctata* (the commonest form in the Dee), its reddish-colored sarcodae rendering it easy to distinguish on the surface of the water." Further on he says, "They (Foraminifera) may always be got by carefully scraping the surface of the velvety brownish mud at the bottom of pools left by the tide, or by skimming the top of the water, if this mud be found to have risen under the influence of sun-light. The oozy mud may be got rid of by washing through a muslin net, and the residuum put into small bottles filled with sea-water." It will be observed that Mr. Siddall is here speaking of the shores of the Dee Estuary which are more or less muddy. I have not succeeded in obtaining living Foraminifera by this method from the tide-pools of a clean sandy shore.

(to be continued.)

Geological notes of Acireale

BY.

GAETANO PLATANIA.

Acireale is certainly one of the best head-quarters for naturalists, especially for those who wish to visit Etna. It is celebrated for the richness and variety of forms presented by the marine fauna and flora of its shores, and particularly of those stretching

along the Sicilian coast from Sta Tecla to Acicastello. Neither botanists nor zoologists in its extramarine fauna and flora, which flourish in its neighbourhood, find and quite a special interest. Acireale possesses a special feature, which, coupled with every modern scientific renders it preferable to any other centre for those who wish to study the natural history of Etna.

Much greater importance is the importance of this city for the volcanologist or mineralogist. In fact from Acireale the ascent to the localities of the most celebrated eruptions is as easy as from Catania, whilst trips to the Valle del Rivo are much easier, as well as to the sites of the interesting and characteristic eruptions of 1852, 1855, and 1870. The neighbourhood of Acireale, with the tufts, basalts and numerous and varied lavas are the most interesting points for the study of Etna.

In these notes of mine I propose to rapidly pass in review the most important of these deposits, which makes Acireale a very rich almost virgin and unexplored field for study.

The town stands about 170 meters above sea-level and is situated on a steep eminence called Timpale which is composed of numerous sheets of lava and beds of tuff. A plain extends northwards, in part covered by the current of 1729 which reached the sea. Along the coast different mineral-water springs gush out, many of which have not yet been analysed. At Pizzillo's a spring of ferruginous water which is much used in Acireale; there is also a magnesian one, and another at Stazzo also probably magnesian, whilst a saline one gushes forth from the volcanic rocks at Sta Tecla at 50 m. from the sea shore.

Beneath the lava stream of Santa Tecla a curious and rare object was found which is now preserved in my own collection. It consists of a piece of wood, possibly the stem of a vine, which having been enveloped in the flowing lava was carbonized and cracked in such a way that the magna from its great fluidity penetrated the cracks, making a detailed cast of the wood which has now completely disappeared. (1)

(1) *Sipione Giustino Ruffini* discovered in the lava of Fossile di Acireale, W. of Acireale, other less striking examples which present the same phenomenon. These he has very kindly placed at my disposal and they are now preserved in my collection.

Nearer to Acireale, at that part N. of the Balzo at the Timpa di Mortara, may be observed a curious pre-historic lava which has undergone decomposition into spheroids, so as to appear as though it were composed of so many volcanic bombs, piled one another, and consequently compressed and crushed above. Pieces of this lava scale off in concentric shells, more or less rounded, until a less decomposed nucleus is reached.

Under this interesting eminence, just to the E. near Santa Tecla and but a few centimetres beneath the surface, has been discovered an ancient lacustrine basin containing a great number of freshwater diatoms. Curiously amongst these occurs the *Eunotia gracilis* sm. (—*Himantidium gracile*. Ehrb.) which so far has been found in lakes of great altitude above sea-level.

The N. part of the eminence of the Timpa of Santa Tecla is constituted of thick beds of tuff intersected by some horizontal sheets of lava. I have not, so far, collected any plant remains in this tuff such as are found in so many other tuffs of Etna, and even in the neighbourhood of Acireale; but it is very probable that they exist. Near the town a prehistoric lava has been precipitated from the Balzo forming an enormous lava cascade, the surface of which is now capable of cultivation, and on which stands the Villa Belvedere. Amidst the scoria of this stream are to be found good crystals of Specular Haematite and vernicular silica, just as is the case in the middle of the town in the lava on which is built the Piazza del Duomo.

On the shore under the great cascade of lava is the celebrated Grotta delle Palumbe excavated in a lava of earlier date and which presents a splendid prismatic structure. This Grotta delle Palumbe, which has been compared to Fingal's Cave in Staffa, although damaged by the fury of the waves, is still beautiful to see with its walls rising straight up from the water and composed of radiating prismatic lava, whilst the bold and fantastic reefs which surround it form a most admirable passage.

Beyond the great lava cascade, the eminence (Timpa della Tecla) is composed of numerous parallel beds of lava of different thickness, varying from 2 to 10 m. which dipping to the S. disappear beneath the sea. These old lava streams alternate

with beds of red pozzolana. In the lower lava beds beautiful radiated Aragonites can be collected, and white, pink, red-brown and green spheroids of the same mineral, together with Sphaerosiderite, Vivianite Mesotype, Opal and Chalcenony. In one lava stream of considerable thickness near a bed of white tuff in which vegetable impressions have been met with, are to be found beautiful examples of Olive of one centimetre or more in size.

One fact worthy of notice is the state in which the larger crystals of Hornblende occur in the lower lava beds. These crystals are sometimes cracked and the fissures have been penetrated by the magma as in those beautiful examples from Milo; sometimes the process is so advanced as to have reduced the crystals to fragments, more or less numerous, which are cemented together by the magma so as to assume an irregular polyhedral form. Around these crystals there often occurs a vacant space so that they can be easily detached from the matrix. (1)

(to be continued.)

NOTES AND NEWS.

A sub-committee has, we hear, been appointed by the Maltese Agricultural Commission to inquire into and report on the "Bird Question" which has of late been exciting so much public attention in these islands.

A movement has been started in Melbourne, for the passing of a law which may tend to prevent the wanton destruction of birds in the Colony.

A deputation, organized by the Victoria Field Naturalist's Club, and representing numerous influential societies, lately brought the subject

(1) *It is of very common occurrence for a rough irregular solid body enclosed in lava to be surrounded by a cavity. The cause of it is undoubtedly the presence of a large free surface at which the evolution of H₂O and other gases in solution take place with ease and freedom, as illustrated by a crumb of bread in a glass of champagne.*

under the notice of the Minister of Customs. In introducing the deputation Messrs. G. D. Carter and J. Bosisto dwelt upon the necessity of protecting insectivorous birds, and referred to the draft of laws which they proposed to enforce, laws where were already in operation in Great Britain and other colonies.

One by one the veterans of science are being removed from the rolls by the hand of Death. On the 19th of December last Sir Richard Owen the celebrated paleontologist died at his residence at Sheen.

A German physiologist claims to have proved quite conclusively that the germs of consumption may be and have been conveyed from one person to another by the bed-bug.

Bad news reaches us from several of the country districts of Malta. The sulla (*Coronarium hedysarium*) one of the staple productions of the island is said to be badly attacked by a species of disease the exact nature of which is at present unknown.

This is serious indeed for according to the report recently drawn up by N. Tagliaferro Esqr. 13,657 tummoli of land are devoted to the culture of this plant, and therefore should the sulla crops fail, the Maltese farmer will be deprived of one of his most important mainstays.

The fishing industry of the Maltese Islands has of late years been steadily on the decline, a fact that has given rise to much anxiety not only to that class which is immediately dependent upon it as a means of subsistence, but also to the public in general.

During the last twenty years an uninterrupted process of extermination has been going on around the Maltese shores with the result that certain species of fish that were formerly very common are now most rare, or are never met with. The subject has been occupying the columns of the

local press during the last month. It is to be hoped that the government of the Islands will be able to see its way to a lot of the suggestions as to the advisability of either defining a fishing limit, of establishing a close season, or of prohibiting the use of those instruments which experience has shown to be the most injurious to the fishing interests.

Olive culture in Southern Spain is rapidly declining and already many of the largest of the olive groves around Barcelona have been replanted with vines. Nor is this to be wondered at considering the revelations that have recently been made regarding the manner in which spurious "olive" oil is manufactured in America and Africa.

17,500,000 gallons of cotton-seed oil were manufactured in the United States in 1890, and of this 27 per cent was used for adulteration in the olive-oil trade. Large quantities of this and of ground-nut oil from Gambia and Zanzibar were shipped to Leghorn in Italy, from whence, after being mixed with a small percentage of the oil of olives, the product was again exported as pure olive-oil.

The dromedary parcel-post service in the German territories of Southwestern Africa has given results better than were expected. The dromedaries are adapted to the climate, are not affected by the prevalent cattle diseases, are not made footsore in stony regions, and do not suffer extreme thirst when deprived of water for a week. They travel, each carrying a weight of 250 pounds, about at fast as an ox-team.

Naturalists have recently proved that under certain conditions about the time of moulting, the horned toad (*Phrynosoma coronatum*) ejects from the eye a small quantity of blood. One observer angered one of the toads when blood spurted from just above the eye to a distance of a foot, and the creature fell exhausted. After five or ten minutes renewed irritation caused a second spurring, but no further repetition of the effect could be produced.

Editor, J. H. Cooke, B.Sc., F.G.S., Malta





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The Mediterranean Naturalist.

A Monthly Journal of Natural Science. Subscription 5/- per annum.

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To Correspondents.

All communications intended for insertion should be written on one side of the paper only; and should reach the Editor on or before the 12th of the month. Whenever an answer is required through the post, a stamped and directed envelope should be enclosed.

Communications for the Editor should be addressed to Highland House, St. Julian's, Malta.

The attention of subscribers is invited to the notice on page 6 of the covers.

Some evidences of the occupation of the Maltese Islands

BY

PREHISTORIC MAN.

JOHN H. COOKE B. Sc., F. G. S.

During the last half century the researches of the Maltese Archeologists Dr. C. Vassallo, and Dr. A. A. Caruana have done much towards filling in the hiatus which had existed in the history of the Maltese Islands from the time when the Phœnicians erected the megalithic structures of Hagiar Chem and Mnajdra down to the present day; and in tracing out the chronologic successions of the various races that have inhabited the islands during the intervening 3,000 years.

The historic period of the islands began about 1,500 B. C. when as Diodorus Siculus informs us the Phœnicians took possession of Malta and remained in it till 750 B. C., after which it was successively under the sway of the Carthaginians, Greeks, Romans, Arabs, Knights, and English.

The light which the scientific researches of Vassallo and Caruana have thrown upon this comparatively recent epoch has placed us in possession of a mass of historical information of a most thorough and reliable character; but of the epochs that preceded this period their work has taught us nothing.

The evidences of the occupation of the caves of Gibraltar, of Mentone, of Provence, of Southern Italy, and of Sicily by early man have, however, led geologists and archeologists alike to look forward hopefully to the time when similar evidences would be forthcoming in the Maltese islands. In the course of their researches both Vassallo and Caruana were always on the *qui vive* for any indications which might tend to clear up this most interesting point; and Prof. Leith Adams, whose geological work has rendered Malta classic ground

most carefully watched for any signs of the former existence of man in the caves and fissures of the islands.

But the results of the work of all, in this direction, were equivocal and unsatisfactory.

"On one occasion," Adams tells us, "when engaged digging in the gap (Benhisa) among the red soil and water worn blocks with my friend Capt. Swann, and we were removing a portion of an elephant's thigh-bone from between the firmly impacted stones, there appeared among the debris a triangular and awl pointed fragment of the calcareous sandstone (*Globigerina* limestone) thickly encrusted with stalagmite, which, when removed, displayed a flat, even surface gradually tapering at one end to a curved point,—such a tool as might have been useful to a primitive race in making holes; but as it bore no traces of chipping, and assimilated closely to many other waterworn stones in the gap, I finally rejected it." (1)

A doubtful discovery was also made in one of the suburbs of Valletta, a brief account of which is given in Dr. Davy's "Observations on Malta" (2) in which he says "At Casal Pietà, close to the city of Valletta, there has been recently discovered a remarkable funnel-shaped cavity in the side of a hill, (3) partially filled up with clay, in which were were found embedded a portion of a bone probably of the radius of a ruminant, probably of a goat, accompanied with masses of chalk and water-worn stones, and a hard stone, the form and appearance of which clearly indicated that it had been fashioned by the hand of man."

Mr. Frere F. R. S., addressed a letter to Davy on the subject in which he described the supposed implement as being, "a piece of hard and very heavy stone, about four inches in length and two and a half in width; it was irregularly fractured at the back and at the edges, but on the other and larger side reduced to what may be called a

smooth surface, that is to say smooth, with the exception of the traces of the instrument which had been employed for the purpose of giving it an even surface.

These traces are very distinctly observable upon it. This stone like many others which were found embedded in the same clay, was covered with a black fuliginous varnish, a mark of authenticity, which if I had had any suspicion of the good faith of the workmen, would have been sufficient to remove it."

The specimen was afterwards unfortunately lost.

In 1865 Prof. A. Issel (1) visited the Har Dalam cavern, Malta, and at a depth of two feet from the surface he discovered several bones of mammals that had been subjected to the influence of fire, the ashes of which were still *in situ*, together with fragments of a coarse kind of pottery.

He thus describes the results of his visit, "Praticato uno scavo di 60 centimetri di profondità nel terreno della caverna, alla distanza di un centinaio di passi dalla apertura, si trovarono ossami di mammiferi che avevano subito certamente l'azione del fuoco e con essi residui di carbone. Due di queste ossa sono il primo ed il terzo osso di un metatarso destro d'ippopotamo. Le altre appartengono a piccoli erbivori, probabilmente ad una specie di *Ovis*, e sono omeri, metacarpani, metatarsiani, ecc. in gran parte spaccati per estrarre il midollo.

Tutte le ossa, non escluse quelle d'ippopotamo, portano tracce evidenti di cottura. Desse erano accompagnate nel terriccio della grotta, oltrechè da residui di carbone e ceneri, anche da cocci di stoviglie grossolane, fra le quali merita speciale menzione un grosso frammento d'anfora, ornato di fregio a graffito, in *zic-zac*, non dissimile da quelli che si osservano su certi rasi proveniente dalle palafitte della Svizzera e del Piemonte."

Such were the only evidences, meagre and doubtful as they are, of the occupation of the Maltese Islands by prehistoric man that had been collected prior to the work which I did in the Har Dalam cave in the spring of 1892.

(1) Adams A. L. "Nile Valley and Malta" 1870. p. 195.

(2) Davy. "Observations on Malta" Vol. 1. p. 111.

(3) This cavity is located in the garden of Villa Frere. It was cleared out to a depth of 61 feet by Mr. Frere; but has since been half filled in with rubbish.

(1) Issel A. "Note sur une caverne à ossements d'île de Malte" *Materiaux pour l'histoire de l'homme* Janv. 1866.

The details of the physical characters and surroundings of the gorge and cave, as well as of the most interesting fauna which was discovered within their precincts are given at length in the report which I made to the Royal Society; and it will therefore only be necessary upon the present occasion for me to allude to their more salient features. (1)

From the particulars which I have given in that report it will be seen that the deposits of the cave belong to two distinct epochs each of which is characterized by a special fauna. In the lower series were found the remains of *Ursos arctos*, *Hippopotami pentlandi*, *Elephas mnadriensis* and a few remains of *Cervus barbarus*; while the upper layers were found to abound with the remains of several species of deer, rolled and broken fragments of hippo which had been derived from the underlying beds and land-shells of living and extinct species. They also contained numerous fragments of a rude, coarse kind of pottery, a stone implement, and the metacarpal bone of a human skeleton.

It is probable, therefore, that the fragments of hippo bones to which Issel alluded in his paper as presenting the appearance of having been roasted were some pieces that had been derived from the underlying beds, which at this point of the cave are six feet in thickness; and that were afterwards deposited with and embedded in that portion of the bed upon which the fire was lit. It was to this that they owed their charred appearance.

The stone implement referred to, I found in the upper portion of the deposits of Trench VI, and in the same part of the cave in which Issel conducted his investigation. The order in which the beds lie in this excavation is as follows:—

In that year I commenced a series of excavations in the course of which some valuable and interesting evidences bearing on the character of the early Maltese settlers were obtained.

(1) Cooke J. H. "The Har Dalam Cavern and its ossiferous contents."

Cooke J. H. "On the occurrence of *Ursus arctos* in the Malta Pleistocene," *Geol. Mag.* Dec. 1892.

- | | | |
|-----------------|---|---|
| Upper division. | } | a. A layer of loose, rounded boulders and pebbles of Lower Coralline Limestone having a maximum thickness of two feet. The stones had evidently been thrown in to this part of the cave when the entrance was cleared for the purpose of making a goat-shelter. |
| | | b. Present cave floor consisting of a light, marly soil, nine inches in thickness and containing numerous land-shells, roots of plants, limpet shells, a shell of a <i>cerithium</i> and the vertebrae of a small fish. |
| | | c. A stratified layer of rounded boulders intermixed with a gray marly loam containing an abundance of land-shells. |
| | | d. A friable marly loam with a few water-worn pebbles, and a considerable quantity of entire antlers, jaws, and limb-bones of <i>Cervus barbarus</i> , together with fragments of very rude pottery and a stone implement. |
| Lower division. | } | e. A layer of indurated, light grey loam containing a few broken antlers, teeth and bones of <i>C. barbarus</i> , five canines and a jaw of <i>Ursus arctos</i> , and vertebrae and limb-bones of <i>Hippo pentlandi</i> . |
| | | f. A layer one foot, six inches in thickness similar in composition to e. but still more indurated. Molars, portions of tusks, and limb-bones of <i>hippo</i> were found lying at the base of this layer, on the original rock floor of the cavern. |

It was at the base of *d.* and immediately overlying *e.*, a depth of two feet three inches from the present cave floor that the implement (1). was found in association with several fragments of coarse pottery. A similar kind of pottery was also found distributed throughout *d.* associated with the remains of *cervus*: but it is a significant fact that no pottery or other evidences indicative of the presence of man were found below the line of demarcation which separated *d* and *e.* The tool is nearly rhomboidal in section, its diameters measuring respecting 2 inches and $1\frac{1}{2}$ inches; and the length of its cutting edge $1\frac{3}{4}$ in.

(1) Dr. A. A. Caruana, who has had an opportunity of examining it, is of opinion that it has undoubtedly been fashioned by man.

It has been fashioned out of the piece of black crystalline limestone, a compact, close textured variety of the Lower Coralline Limestone, (1) out of which the numerous boulders and blocks of the Benhisa Gap have been formed. With the exception of occasional flint and chert nodules which are found in a zone of limited area (div. c. d.) in the Globigerina Limestone, this black limestone is the heaviest, and most compact of the Maltese rocks. The localities in which the flint and chert nodules occur are comparatively few and are widely scattered over the islands (2); besides which there are few natural exposures of the zone within a radius of eight miles of the Har Dalam district, and in those that do occur I have failed to find any siliceous substances other than of microscopic size. The preference, therefore, which was given to the more prevalent black rock for the purpose of fashioning the implement admits of a ready explanation.

The top or shorter faces of the specimen is very irregular in outline, one of the faces having been roughly chipped into shape; but the other faces are comparatively smooth, and exhibit traces of having been rubbed down to their present form.

The cutting edge which has thus been formed is very sharp; but it has been slightly fractured in two or the three places.

On the exterior surfaces of the implement there are several small incrustations of carbonate of lime the greater portion of which is found in and around the corners and other inequalities of the fractures. (3)

The fragments of pottery which were found in the same layer were very coarse in their texture and composition. The material is of a very rude description, the interior between the inner and outer surfaces being quite black and unset; while the surfaces themselves are very coarse and rough.

(1) Cooke J. H. "On the occurrence of a black limestone in the strata of the Maltese Islands." *Geol. Mag.* No. 338, p. 361, Aug 1892.

(2) Cooke J. H. "On the occurrence of flint and chert concretions in the Maltese strata." *Geol. Mag.* Mar. 1893

(3) The Hon. John Worthington, Consul for the United States, was present at the time that it was found and assisted me in taking notes of the conditions of its occurrence; and upon another occasion H. S. H. Princess Victoria of Battenberg obtained several pieces of coarse pottery from the same horizon in Trench I.

It differs in every respect from that of which the potsherds are made which are found in the superficial layer near the cave entrance, and with the Phœnician and Punic ware which abounds in the rock-tombs of the islands.

The broken state and shapeless forms of these fragments afford us little or no information as to the social condition of the people who manufactured them, but judging from the surroundings and associations it does not seem probable that the people were very far advanced in civilization. The ware seems to have been made for a utilitarian rather than for an ornamental purpose. The Phœnician ware of the rock tombs exhibits considerable skill in the art of pottery, which is no more than we should expect considering the account which Pliny gives of these people whom he tells us were the "originators of vitrification, or glass making."

Farther within the cave and situated in the widest and most lofty part of it, is Trench IV, in which were found, intermingled with a miscellaneous assortment of other remains, the metacarpal bone of a human skeleton (1)

The excavation which was nine feet long, five feet wide, and five feet six inches in depth exhibited in section the following deposits:—

- | | | |
|-----------------|---|---|
| Upper division. | { | <p>a. Six inches of red and black clay containing numerous stalagmitic bosses, and stalactitic pendants. Some of the latter were one foot six inches in length, and four inches in diameter. No organic remains; but fragments of pottery were plentiful.</p> <p>b. A layer of clay similar to that of the overlying deposit, but containing an interstratified seam of subangular boulders and pebbles of Lower Coralline Limestone most of which were in an advanced state of decay.</p> <p>c. A layer of brick red loam, three feet in thickness, containing a few small, rounded pebbles.</p> |
|-----------------|---|---|

(1) The remains were examined and determined by Mr. A. S. Woodward F. G. S., of the British Museum.

- | | | |
|-----------------|---|--|
| Upper division. | } | <i>d.</i> A layer similar in every respect to <i>c.</i> except that it is more indurated. It was three inches in thickness, and contained the greater portion of the organic remains which were found in this part of the cave. It forms a sharp line of demarcation between <i>c.</i> and <i>e.</i> It contained two broken hippo molars, and several rolled fragments of hippo bones; besides numerous rolled portions of antlers, teeth, and limb-bones of cervus. It was from this layer that the human bone was obtained. |
| Lower division. | } | <i>e.</i> A layer of yellowish white clay, one foot six inches in thickness. With the exception of the rolled organic remains it had nothing in common with the superincumbent deposits. The remains were found only in the upper part. |
| | | <i>f.</i> An osseous stalagmitic layer eight inches in thickness, and containing a great quantity of teeth, tusks, and bones of hippo. |

All of the layers exhibited distinct traces of stratification; and all of the organic remains appeared as though they had been subjected to a considerable amount of illusage before being deposited. The intermixture of the remains of the two epochs in layers *d* and *e*, their rolled condition, and the isolation of the molars and splintered condition of the bones seem to indicate that the remains found in these layers had been transported from one part of the cave to the other by flood waters. In this same trench was found an isolated metatarsal of a species of *canis* equalling a wolf in size.

These facts will assist in explaining the occurrence and isolation of so small a bone as the metacarpal of a human being.

The layer in which it was found is at an horizon equivalent to that of layer *d* in trench VI.

Such then are the evidences bearing on the prehistoric anthropology of the islands which these excavations have supplied us with, evidences which I venture to think will be admitted as having added one more arch to the bridge with which the geologist and the archaeologist in these islands are endeavouring to span the gulf that at present divides their labours.

It will be observed that all of these rude manifestations of the presence of primitive man have been found to occur at about the same horizon and in the upper division of the deposits. The remains of hippo, that were discovered at or above this horizon were always fragmentary, and afforded every evidence of having been derived from the underlying beds by the disturbing influence of the waters that formerly flooded the cave, and laid down the deposits. Besides which, the different states of mineralization in which the hippo the bear, and the elephant remains, and those of the various species of deer, horse, etc are found, clearly indicate that the two divisions belong to two distinct epochs each of which was characterized by a different fauna, and by different climatal conditions.

It was to the later of these two epochs that the man belonged who left the remains of his pottery, his fire, his implement, and his skeleton in the Har Dalam cavern.

Of the question then, as to whether man occupied the islands contemporaneously with the hippo and the elephant, we still know nothing.

But it might be asked what age should be assigned to the deposits in which these evidences of mans existence have occurred? To this question it is not possible, at present, to give a definite answer.

When however, we consider the account which Diodorus Siculus gives of the comparatively high state of civilization of the island's inhabitants at even so remote an epoch as 1500 B.C., to 750 B.C. in which he informs us that "Malta is furnished with many and very good harbours, and the inhabitants are very rich, for it is full of all sorts of artificers, among whom there are excellent weavers of fine lincn. Their houses are very stately and beautiful, adorned with graceful eaves, and covered with white plaster. The inhabitants are a colony of Phoenicians." (1)

It seems hardly probable that materials so rude, or tools so primitive as those found at Har Dalam had their origin at that period.

The discovery of these evidences derives further value too from the geologic horizon at which they were found, and the fauna with which they were associated.

(1) *Diodorus Lib. VI.*

The greater part of the latter consisted of the remains of several species of deer, similar remains of which were also found to occur in the Pleistocene beds at Duera (1) and Tal Asiri in Gozo; and of a species of *Helix* which is no longer found to exist in the islands.

The state of mineralization in which the bones were found was most complete; and when in addition to these facts we take into consideration the height at which the cavern is now situated above the present valley bed, and the period that would be required to excavate the valley to its present depth; the character of the climatal conditions which effected such wholesale degradation as the district around bears testimony to, and of the time which must have elapsed between then and the establishment of the present favourable conditions; and lastly of the fact that the Phœnician, Punic, and Greek remains and their surroundings, that are found in the denuded portions of the islands offer no evidences to show that the rate of degradation of the islands' surfaces has increased or diminished during the last two thousand years, or that the climatal conditions were much different then to what they are now—when these and the other equally important points referred to in my report are duly weighed I think we should be justified in assigning to the remains of the prehistoric man found in the Har Dalam Cave an antiquity that would carry us back to an epoch considerably more remote than that to which Diodorus and Pliny refer in their accounts of the people who, hundreds of years before the Christian era exerted their civilizing influences from the banks of the Tigris to the British Cassiterides.

The Malta Potato Disease.

In a paper contributed to the "Journal of the Royal Agricultural Society of England." Mr. Chas Whitehead gives some interesting and valuable details of the results of certain experiments which were recently tried for the prevention and cure of the potato disease.

According to his report there is a unanimous verdict on four points.

1. That the dressing with the sulphate of copper and lime solution which was recently given in the *Mediterranean Naturalist*, though it does not entirely prevent disease, has a marked effect in lessening the extent to which the disease appears.
2. That associated with the lessening of the disease is an almost certain increase of crop, which more than pays for the cost of application of the dressing.
3. That the best treatment is an early application of the mixture before disease has made its appearance, and that this should be repeated if the marks of the first dressing have been removed by rain.
4. That even if delayed until disease comes a lessening of the spread of disease may to some extent be effected by a late dressing, and the crop will, as a rule be sufficiently increased to pay for the application.

After this very clear pronouncement the use of this mixture ought to become general among Maltese potato growers.

The Relationship of the Structure of Rocks to the conditions of their Formation.

By H. J. JOHNSTON LAVIS, M.D., F.G.S., ETC.

Quartz appears never to have been produced artificially, except from solution in water of silicates of a glass at a high temperature and pressure by Daubrée; and from the abundance of fluid cavities seems to be the result of (in rocks) hydrothermic origin under very great pressure.

Leucite, although a mineral of local occurrence, is of deep interest to the petrologist. It has never been met with amongst furnace slags, except as a sublimation. M. Hautefeuille (1) obtained measurable crystals by fusion of the components of leucite in vanadate of potash. Fouqu   and M.

(1) Cooke J. H., "On the Pleistocene Beds at Gozo" *Geol. Mag.* Vol. VIII., p. 326., Aug. 1891.

(1) *Annales Scient. de l'Ecole norm. sup.* 2nd series. vol. ix., 1880.

Lévy (1) obtained by igneous fusion and *recuit* without a flux. With the components of leucite alone it was impossible to obtain the mineral, and this could only be done by taking equivalent components of a mixture of that mineral and pyroxene. This is a most important fact that again helps to clear away the veil of mystery which overhangs the genesis of many silicates.

Most substances can be obtained crystallized by one or more of four principal methods—from sublimation, by fusion, by evaporating a solution, and by cooling down a solvent. The necessary temperature is highest for the first, less for the second, and very much the lowest for the third and fourth. Sulphur, to be obtained in crystals from fusion, requires a temperature of at least 115° C., whereas by solution in carbon bisulphide we may obtain crystals far more perfect at the ordinary temperature of the air.

We must, therefore, look upon leucite as dissolved in a medium which is liquid at a bright red heat, and only gives up this, as well as other minerals, by a lowering of temperature, in the same way that a mixed boiling saturated solution of salts of various solubilities separate out (far below their fusing point) as the solvent cools. Precipitation might also depend upon withdrawal from the mixture of one or more of its elements for the formation of a mineral that has already commenced to separate.

If we take a solution of mercuric biniodide in a solution of potassic iodide, and add some substance that will seize upon the iodine in the latter salt, such as argentic nitrate, we have an immediate precipitate of the mercuric biniodide proportional to the amount of potassic iodide broken up. Stoppani gives the example of nitrate of potash dissolved in water, which is precipitated immediately if alcohol is added. (2)

The fact, therefore, of leucite crystallizing far below its fusion-point proves the solution of that mineral in that glass or some other.

This would explain the crystallization of the two minerals simultaneously, as at Roccamonfina; for as the lowering of temperature took place in the magma as the pyroxene crystallized out, the

remaining would become supersaturated with leucite, which would have to separate. We might possibly imitate this condition in freezing a saturated solution of a salt in water. It is also possible that the leucite does not form until the potassic chloride in the magma has been broken up, and the HCl has escaped in the vapour.

In the formation of rocks we have a process of fractional exhaustion of the original amorphous medium, in which secondary combinations can hardly be conceived to take place until some portion assumes definite crystalline form, the kind of which will depend upon the elements that enter into the composition of the mixture, and the train of conditions which that undergoes in passing from a higher to a lower temperature.

Starting, for example, from an amorphous mass of fused silicates, we may suppose that condition 1 is favourable to the formation of mineral B, but as this separates, A can no longer remain in solution, so this also separates until the magma is deprived of as much of the elements as these minerals A + B can take up, and the glass is then suitable for the growth of C which comes next, and in its turn may be followed by D, and so on. The resulting rock will be composed of the minerals A + B + C + D, &c. Let us again start with the same magma, and suppose that condition 2 comes into play, which is favourable to the formation of A, which will separate, exhausting the magma to a point that is suitable to the formation of X, in preference to any other, which now carries the exhaustion on, till the magma approaches Y in composition which in turn continues the exhaustion, till the unformed material is suitable for the crystallization of D. We should thus obtain a rock containing the minerals A + X + Y + D, both of which would be identical in ultimate chemical composition. Now, condition 1 may have been favourable to rapid expansion, and eruption such as pumice results from whilst condition 2 we may take to represent the gentle outflow of lava. The reality of this somewhat rough illustration will be more apparent if we compare the vitreous pumices of *Phases III. and VI.* of Monte Somma, in which leucite is absent, and sanidine abundant, with the highly leucitic basalt lavas of the same volcano, in which sanidine at the most is a very an important element, remembering

(1) *Comptes rendus*, 1878. t. lxxvii., p. 961.

(2) *Corso di Geologia*, vol. iii., p. 131.

at the same time the practically complete identity in chemical composition of the mass of either. An interesting point in connexion with this is the fact that Messrs. Fournquè and M. Lèvy obtained a leucitic rock from fusing together orthoclase and biotite. Prof Samuel Haughton (1) was, I believe the first to treat the mineralogical composition of a lava on the principle of the exhaustion of the element of the magma or paste, the different minerals competing for certain oxides which are necessary for their formation, so entirely devoting himself with remarkable ingenuity to the chemical side of the question, but disregarding the physical, which however, hardly entered into the scope of the subject discussed. We must however not forget the varying conditions under which cooling, in an igneous rock, takes place, such as time, pressure, water volatile acids, and their corresponding salt which must be most important elements in modifying the ultimate mineralogical composition of the solidifying rock. Let us take two groups of the mineral elements of Vesuvian *essential* ejectamenta; we have leucite antagonistic to amphibole, nepheline, and mica, all competing for the potash. Now in the pumices of the great explosive eruptions of *phases III. and VI.* We find amphibole sanidine, and iodide busing up the potash, and being the principal crystalline ingredients, whereas in the lavas that cooled under quite different conditions we find these minerals reduced to a minimum, whilst all the potash has been seized upon by the leucite, and sometimes a little nepheline. How can we account for such phenomena, otherwise than in change of conditions?

(to be continued.)

Notes for the month.

Botany

Whilst on the continent at this season
"O'er hill and vale and wood.

"Sweeps the snow-pinioned blast, and all things
"veils in white array" flower hunting is either a remembrance or a myth. But in Malta

"Advancing spring profusely spreads abroad
Flowers of all hues."

and decks the country and valleys with some of the brightest of field gems.

Indeed, I do not think we have anything like a winter flora; for, the flower season of Malta is divided into two periods, the first of which includes the plants which bloom from January to March, the second those which come in flower from March to May, and these are the greater number, without mentioning those which flower from January to May. From May to September our few summer species struggle out "to blush unseen" on the parched soil and in the dusty air, crowding in all possible localities which afford some moisture. Lastly, from September to December a few more, which bear on autumnal character linger still while the spring species are already budding and putting out their leaves. The consequence is that we have many spring flowers, a good number of summer and autumn ones, but we have no true vernal species.

It would appear therefore that an early spring flora replaces the vernal one, and accordingly many plants now in flower will shortly give place to those which characterize the latter period of our spring.

Of those now in flower the most interesting are:

Our only heath—*Erica multiflora* L. and *Pistacia lentiscus* L. both of which adorn the rocky sides of our valleys;

Orchis lactea Poir. and *Orchis saccata* Ten. one of our more curious orchids and a species of very limited distribution; the rare *Anagris faetida* L. found for the first time last year by the Rev. E. Armitage on the hills of Emtahleb and Maddalena;

Salix pedicellata Desf. prominent amongst our few wild trees, growing, by the water side at Emtahleb and Gineina;

Periploca angustifolia L. on the rocks of Uied Babu and Mistra;

Lepidium graminifolium L. in the old English cemetery at Floriana.

The pretty *Anemone coronaria* L. shows its violet corollas in all barley, corn and clover fields, generally at the same time with the scarlet ones of the Pheasant's eye, the *Adonis microcarpa* D.C., which occupies a place foremost amongst our prettiest wild flowers and which is freely used by our flower sellers in the place of garden ones.

(1) *Op. cit.* pp. 68 and 138

Such common forms like *Diplotaxis erucoides* D. C., and *vininea* D. C., *Fumariae*, *Geraniums*, *Bellis*, *Erodiums*, *Cerastiums* and *Silene bipartita* Desf. in particular, cover now all the ground but lately mantled by the *Ranunculus bullatus* L., and gladden the sight by their varied tints.

Moss collectors must also make the best of their time now if they wish to have a good crop of mosses and liverworts in fructification, the same ought to do persons interested in fungi and lichens.

The sea on its part offers a good amount of deep sea algae which the gregale throws on beaches, besides many interesting species in fruit amongst the littoral ones.

If to this be added the lovely weather which generally favours excursionists at this season of the year, it will be seen that for lovers of flowers as well as for botanists there is plenty of work to do at present and there will be a good deal more to be done in a few weeks.

Conchology.

The same cause that has created an unusual abundance of caterpillars, and hence of butterflies, has acted similarly on slugs and snails which have been and are still infesting our country.

In September we have generally the first rains which awaken mollusc life from its summer torpor. The snails then begin to lay their eggs. The chance of hatching these depends much upon the weather that follows. Sometimes the rains hold off for a long time, the soil then dries again and plants grow very slowly. In such cases snails do not fare well and from the drying up of their eggs and the dying of the young there is no reason to expect any alarm from extra numbers. But if the soil continues moist on account of frequent rains and the crops offer a precocious growth, as we have had this year, the snails under these favourable circumstances make themselves very obnoxious to the poor countrymen. I regret to say that this season has been for snails an annus mirabilis, and their numbers are seriously damaging our vegetable products.

The species which I have seen in greatest abundance are, as it was to be expected, the most damaging ones, viz. those which prefer field products to weeds; these are *Helix aperta*, *vermiculata* and *aspersa*.

One has simply to go into a cabbage or clover field and see for himself the incredible number of young snails he will find feeding on every bit of green. When adult their habits are different, the *H. aperta* burrows a hole in the ground and hides itself there, and *H. vermiculata* and *aspersa* stick under stones or on walls; but in their young state all of them live on vegetables, destroying the more delicate parts of the plants and spoiling whole crops. If their extraordinary quantity were to be the occurrence of every year, it would be a serious threat to our products, and it would be a matter of great consideration, but we are not likely to have often such wet winters as this; and our long summers are all but favourable to the extra crowding of molluscs—it may be therefore hoped that snails will not bring upon us the necessity of proposing them, as to is continually being done to the inhabitants, an emigration.

A. C. G.

The Collection and Preparation of Foraminifera.

BY EDWARD HALKYARD, F.R.M.S.

(continued)

Not having had any personal experience in the collection of Foraminifera by dredging, I will in connection with this class of work, only describe briefly a dredge which I imagine will be found useful in securing specimens. The dredge, consists of the common naturalist's dredge, with the addition of a bag made of canvas or some other material of open texture, partially covering the ordinary net-bag of the dredge. The canvas bag is not sewn up at the bottom, but securely tied by means of a piece of cord or spun-yarn. In using this dredge the larger objects taken will remain in the net-bag (which is closed at the bottom), whilst the sand, and small objects will be washed through the netting into the canvas bag, and when the dredge is hauled up can be emptied out by untying the bottom of the bag.

Fossil Foraminifera should be searched for in sandy deposits, soft shales, clay partings between beds of limestone or sandstone, and in clay-beds of a marine or estuarine nature. The chalk formation is often written about as yielding many

beautiful specimens, but though it is true that the whole deposit is full of these organisms it is difficult to separate them from the matrix. They may be obtained from the gritty powder which is sometimes found at the foot of a chalk cliff, and is the result of the action of the weather upon the soft rock, but the best specimens may be got from the interior of hollow flint nodules. It is not difficult to tell which nodules are likely to prove productive. Those perforated with holes and having a semi-decayed appearance should be selected, and after being broken by a blow from a hammer will often be found to contain a quantity of greyish white powder, in which Foraminifera and sponge-spicules may at times be found in abundance. In the autumn of 1887, under the guidance of Mr. S. A. Stewart, of the Belfast Museum, I spent a most enjoyable day amongst the quarries in the Chalk Limestone of White Well and Cave Hill, near Belfast, co. Antrim, and brought home a heavy bag of material obtained from the interior of flint nodules. I was informed, whether by Mr. Stewart or Mr. Joseph Wright, I do not now recollect, that the chalk beds in the neighbourhood of the sea were most prolific in these partially decomposed flints.

The Gault Clay of Folkstone will be found to yield a rich harvest to the collector of Foraminifera. I am not at present able to say what particular parts of the thick clay bed are likely to be found to repay best the trouble of washing, but I may mention that I have in my collection nice specimens from that part of the Gault in which fossil *Serpulæ* and the bivalve *Inoceramas concentricus* are found. The specimens from the Gault Clay are often infiltrated with iron pyrites, so that by removing the calcareous shell, by means of dilute acid, beautiful casts of the interior may be produced.

I will now pass on to speak of the manner of treating shore-gatherings or dredgings, in order to separate the Foraminifera contained in them. A quantity of the sand must be placed in a sieve made of brass or copper wove wire gauze of 120 meshes to the inch linear, and a stream of water from a tap directed thereon in order to get rid of all fine particles, and also by washing away such salt as may be present to render the subsequent drying process more complete. No specimens of

any value will be lost by this process, for as the meshes of the sieve do not exceed $\frac{1}{200}$ th part of an inch in diameter, the shells which do escape will only be starved or immature forms of which adult and robust specimens are retained. A sieve of this mesh (namely, 120), will be found to answer for washing most gatherings, but in exceptional cases, in which it may be thought desirable to save particles which would pass through such a sieve, the silk gauze made for millers' use may be substituted with advantage; one with 200 threads of weft to the inch being a useful number.

After the sand has been well washed it should be dried slowly, a great heat in drying is apt to damage the shells, causing thin and delicate ones to break and the thicker vitreous species to become dull and semi-opaque. When the material is dried, sift it through a sieve of 10 wires to the inch to get rid of pieces of shell, fragments of seaweed, and other coarse rubbish, which may, however, be examined separately for parasitic forms.

The Foraminifera must now be separated from the sand and heavy material by the process of "floating." To do this put about a coffee-cupful of the sand into a basin and then pour cold water upon it, stirring the meanwhile with a spoon, the Foraminifera will now float, and may either be skimmed off or secured by the following method, which is more expeditious but requires some simple apparatus. Get a tinplate worker to make a funnel and tripod-stand. Tie a bag made of the silk gauze mentioned above to the lower part of the funnel and the affair is ready for use. Having well stirred up the basinful of sand and water, after allowing a minute or so for settling, pour the water and floating Foraminifera into the funnel, when the water will pass through the gauze, and the shells will be retained. Pour some more water on the sand, etc., in the basin, stir up and decant into the funnel as before, allowing only half-a-minute for settling this time. All the Foraminifera which will float have now been secured, but the sand left in the basin should not be thrown away as useless, for in all probability (especially if it be dredged sand) it will be found to contain the heavier species. The surface of the sand ought to be scraped up with a spoon, dried, sifted, and such particles as will not go through a sieve of 35 meshes to the inch examined under the

microscope, or even by means of a pocket lens.

The floated Foraminifera having been dried carefully (for this purpose, the tripod, funnel, and attached bag, with contents, may be placed near a fire until dry), it will be found advisable to sort them into three degrees of fineness for greater convenience of examination; sieves made of wire-gauze of 20, 40, and 80 meshes to the inch being used.

If fine particles of sea-weed, confervæ, and other fragments of a vegetable character have been floated with the Foraminifera they may be destroyed by soaking the whole "floating" in liquor potassæ for a few days; afterwards the debris of vegetable matter and all traces of potash must be washed away with warm water. This process will not injure the Foraminifera if not continued too long, for even the arenaceous forms resist the action of the potash.

(to be continued.)

The Natural History of Certain Fevers occurring in the Mediterranean

BY

SURG. CAPT. M. LOUIS HUGHES, A.M.S.

(Continued from page 390).

In the last number I described the rod-like bacillus, which is at present accepted by European pathologists as the proximate cause of Enterica (Typhoid fever). Its colonies on agar-agar at the temperature of the blood become visible to the naked eye in about 20 hours, and grow steadily and evenly over the surface from day to day, as a grey film with an indented or branched margin. I now pass on to the second fever on our list.

B. *Mediterranean Fever*. — In the year 1887 a micro-organism, which I shall call the "streptococcus Miletensis" was discovered in Malta by Surg. Capt. Bruce, in the spleens of patients suffering from this fever.

There can be no doubt that this Micro-organism (or a product formed by it) is the proximate cause of Mediterranean Fever, and there are few diseases in which the bacteriological proof is so complete. For while the fever itself has such distinct and constant features both clinically and pathologi-

cally as enable it to be distinguished from all others, this micro-organism is itself clearly distinguishable from others by its microscopical appearances and mode of artificial growth. It is to be found in those parts of the body where from the clinical symptoms one would expect to find it and is I hold present in every case of this fever. It has been found after death by (1) Bruce in eight cases, by (2) Surgeon Gipps, R.N. in two cases and by (3) myself in eight cases.

I know of no other micro-organism present under similar circumstances, nor do I know of any other disease in which this is present. In each of my cases I have carried this micro-organism through six generations of pure cultures. Pure growths of this streptococcus when introduced, with the strictest precautions, into the circulations of healthy monkeys, produce an acute fever similar to severe cases of Mediterranean Fever occurring in man, without causing any local disturbance at the seat of inoculation.

In the bodies of these monkeys when the fever was at its height a micro-organism was found, present in the liver, spleen, and blood, similar in every respect to the streptococcus found in man. Growths of the micro-organism, obtained from these monkeys, after being passed through six generations of pure cultures, produced when introduced into the circulation of healthy monkeys a long remittent type of pyrexia lasting from two to three months, in every way resembling that so common among men in Malta.

This micro-organism, grows best in nutrient material the alkalinity of which is slightly less than that of human blood, and at a temperature of from 37° to 39° C. On the sloping surface of a 1½ per cent. peptone agar, at a temperature of 37° C., its colonies become visible to the naked eye in from 120 to 125 hours after primary inoculation from the human spleen. They first appear as minute, transparent, colourless drops on the surface of the agar. In about thirty-six hours they become of a transparent amber colour, and, increasing very slowly in size, become opaque in from four to five days from their first appearance.

(1) *Army Med. Blue Book* 1890.

(2) *Trans. Epidem. Soc. Vol. IX.*

(3) *Lancet Dec. 8th. 1892.*

At this time they somewhat resemble split pearls lying on the agar surface. Under a low power with transmitted light the colonies appear of an orange colour, quite round, and with a definite but granular margin. If kept on moist agar they increase in size, but remain circular in shape, and gradually coalesce. In the course of three months they turn to a bright buff or even orange colour, and increase in thickness by heaping up at the centre of the colony, but never attain a great diameter. No liquefaction occurs. Though they cease to grow at the end of two months the colonies retain their vitality at a suitable temperature for over three months. They cease to grow at 18.5°C . and die if kept long at a moist temperature below 15.5°C ., but live a long time in a dry state. They will not grow as primary growths on agar having an alkalinity in excess of the blood, but if cultivated in successive media of increasing alkalinity they may be educated to grow in very alkaline media. In this case, however, they are longer in appearing, and grow more slowly and in a very diffuse manner over the surface of the agar, showing at the same time many abortive attempts at colonisation.

These diffuse growths, however, if transferred to agar having a suitable alkalinity, again revert to their original characteristic form of growth. They grow also in gelatine and bouillon. In the former it grows very slowly at 22°C . without liquefying. In the latter it gives rise to a general and increasing opacity, commencing on the fifth or sixth day and afterwards forming a white precipitate consisting of these cocci, but without forming a surface pellicle.

Microscopically in the hanging drop they appear as very minute $0.008-0.3\text{ mm}$. (Bruce), ovoid or nearly round in shape, in rapid molecular motion, and at times to be seen in chains composed of two or more. They stain readily with gentian or methyl-violet and fuchsine, but lose their stain rapidly if treated with alcohol. Mounted in balsam they appear as minute cocci, here and there arranged in short chains. They can be observed in fresh splenic substance after death and in the blood during life of men suffering from this fever.

From accessible data collected from the statistics, records and literature of this fever during the past 70 years, from investigations during a recent localised epidemic, and from the distribution of the cases of this fever, I am led to the belief that

its existence in Malta and Gibraltar is connected with the presence of human excrement.

From the above facts also, and particularly from the fact that on shore the admission rate varies in frequency in inverse ratio to the rainfall, it is highly probable that the poison is aerial in nature and arises from faecal and organic matter in the porous soil, when these are undergoing a process of drying, somewhat after the manner in which the miasm of Malaria (ague) is said to be given off from suitable sources. In this instance it would enter the human frame by way of the air passages.

It is less severe and less frequent in Gibraltar where the rock is less porous and less absorbent. Cold weather would also appear to have some effect in retarding and preventing its occurrence. I have no evidence in favour of infected food or drink having any causal connection with this fever. Its occurrence as an epidemic will I believe be found preventible.

Although this fever is, I am informed, increasing in its frequency among the civil population of Malta, it has steadily decreased in frequency among the troops during the last thirty-three years, owing no doubt to sanitary improvements in barracks. A chart of the admission-rate per thousand of strength since 1860, for the Malta garrison, presents a series of cycles, alternately rising and falling every three or four years. In 1888, 1889 and 1890 it had reached its lowest point and in 1891 it began to rise and has risen still higher in 1892, to reach I presume its maximum this year.

What is now needed so much, is some definite place for this disease amongst fevers and more searching and accurate investigations into its cause, since here in Malta we have so many possibilities of faecal infection and so much fever. The balance of evidence gained by past experience and investigations at present being carried out would point to the following seats of faecal contamination as being likely sources of infection, and I bring them forward at this early stage with a hope that others may be led to give us the benefit of their experience in these matters:—

(a) The old Knight's drains, cut in the porous rock, filled for so many years with often stagnant sewage and now in many instances used as surface and storm water drains. These are more or less

wet and innocuous in winter, a suitable nidus for growth of germs in a damp state in spring and autumn, and being in summer time dry and untrapped would appear to be favourable sources for the disengagement of aërial exhalations.

(b) The floors of many uncemented basements and underground hovels, built centuries ago, and many of the open spaces in our towns and villages are soaked with organic matter, and are likewise alternately wet and dry according to the season of the year.

(c) The water of our tideless harbour is regularly contaminated by ships, etc. and would more especially in the enclosed creeks seem a likely danger to our soldiers and sailors, who not only frequently bathe there, but use this water when washing down decks, and who are at times exposed to exhalations from its foetid mud during dredging and other operations.

(d) Lastly such points of a general sanitary nature, but most important in this particular instance from the probable aërial nature of the poison, such as leaky or improperly rendered cesspits unflushed & faulty drains, and above all insufficiently high ventilators connected with either sewer or surface water drains.

These last causes are daily and rapidly disappearing from Malta thanks to the energy of our Government Sanitary Department and I hope in the future that the study of this fever on the above lines may banish or considerably lessen the occurrence of fever in Malta and indeed the whole Mediterranean.

(to be continued)

Science Gleanings.

Live lobsters, intended to stock New Zealand waters, have been successfully transported from England in cold chambers. The humble-bees taken to New Zealand several years ago have increased wonderfully, and salmon ova have been similarly introduced with promising results.

Australasia is the wonderland of the student, on account of the numerous forms of ancient life that it has preserved. A new addition is found

in the herrings of certain rivers of New South Wales, which prove to be doubly armored, having a row of scutes on the back resembling the ordinary armature on the belly. This peculiarity is found elsewhere only in extinct herrings of the late Cretaceous and early Tertiary periods.

It is estimated that over 19,000,000 persons have been killed in the wars between civilized countries in the past century, and 1200,000,000 during the last thirty centuries. Flammarion, the astronomer calculates that the entire number of corpses would bridge the channel from France to England while the heads alone would form a continuous band reaching six times around the world.

Recent studies of cancer not only indicate that it is an organic growth but almost certainly prove it is itself liable to the attacks of another parasite. Better acquaintance with the relations of these parasites may possibly bring the long-sought method of arresting cancer.

Like other large animals, the elephant is being exterminated. Reproduction is slow, while ivory-hunters are slaughtering 75,000 a year in Africa. Mr. A. G. Poverli, F. Z. S., suggests an effort to induce hunters to capture the animals alive and saw off the tusks. The tusks are solid, and the process would be a humane and painless one.

The doubling of the lines — unfortunately called canals — of Mars has been experimentally reproduced by M. Stanislaus Meunier as an optical effect, and he concludes that transparent clouds may account for the phenomenon observed only by Schiaparelli and a very few others.

A whimsical appearing theory, to the effect that the female yew is harmless to cattle while the male plant is poisonous, has been investigated at an English agricultural college by Lieut Stuart Wortly. Chemical analysis confirms the belief, that taxin, the supposed poisonous principle is confined chiefly or entirely in the male plant. An earlier writer has mentioned that the leaves grow poisonous with age.

In the course of his researches, from which has been prepared a new chart of the currents of the North Atlantic, the Prince of Monaco threw into the sea nearly 1000 numbered and recorded floats, of which 227 were returned with particulars of their discovery on various coasts. A notable result is the tracing of a great ocean vortex to the west of the Azores. Just as in an atmospheric cyclone, there exists in this oceanic vortex a region of calm where the waters do not follow any regular direction, and when the floats enter this region they remain there often for months or years.

Pomologists have been warned by Prof. C. V. Riley against two foreign insects that are likely to appear in the United States. The peach *ceratitis* a subtropical insect resembling the apple maggot, is extremely destructive to the peach crop of Bermuda, and would doubtless prove very troublesome in Florida and Georgia. The Japanese peach fruit-worm is like the codling moth, and in some seasons damages ninety percent of the peach crop of Japan.

In an address to the Royal Academy of Medicine in Ireland, Mr. Edward Hamilton stated that the progress of surgery now rests securely upon three points—anaesthesia, antisepticism and experimental research. In the matter of anaesthetics, he favored ether for adults and chloroform for children. Lest the great work already accomplished should exalt his hearers above measure he mentioned that cancer and tubercle are still incurable, and that little advance has been made in the cure of syphilis. He urged the importance of hygienic treatment, good air, good food, early hours, temperance in all things, the Turkish bath and the blood-making property of cod-liver oil.

The failure of the recent attempt to introduce a destructive epidemic among the rabbits of Australasia has not wholly discouraged the advocates of such a method of reducing the plague. Mr. Miller Christy calls attention to some interesting facts concerning the rabbits of the Canadian northwest. These animals become very scarce for several successive seasons, then in a few years increase to enormous numbers, when they suddenly die off until hardly a living rabbit can be

found. Prof. Hind in 1860 attributed this to exhaustion following a severe winter, but later writers claim to find evidence of disease. The hope is thus revived that a virulent disease peculiar to the rabbit may yet be brought to the aid of the Australian sheep farmer.

Attempts are being made, so says *Nature*, to create a silk-producing industry in the district of Nicolaieff in South Russia, attempts which it is surmised will prove successful. The soil and climate of the country are admirably adapted for the culture of the mulberry tree, so that provided the matter be taken up with energy and determination there seems to be no reason why a thriving and prosperous industry should not be established for the benefit of the peasants and of the poorer classes.

Herr Nagel has recently been conducting some experiments at Naples having for their object the localization of the various senses of sea anemones.

The results of his researches have shown that the sense of taste resides in the tentacles; and that though the tentacles were apparently unresponsive to pain when cut, yet when touched, or when heated substances were placed near them they gave evidences of being most sensitive. They are therefore the seat of three senses viz. of touch, taste, and smell.

According to the Census of 1892 the Maltese Islands have an area of 270,399½ tummoli (a tum-molo = $\frac{1}{16}$ of an acre) or 117½ square miles, and of this 113,083½ tummoli are uncultivated or uncultivable. To put it in other terms 42 per cent of the total area of the islands is little more than bare, sterile rock.

Nature contains a most interesting note on a paper which was contributed to the Kew Bulletin by Mr. E.H. Floyer, F. L. S. Inspector General of Egyptian Telegraphs in the course of which we are told that the country between the Nile and the Nile and the Red Sea has not always been so barren as it is now.

There is ample evidence that in former times bodies of cavalry from three to five hundred in number ranged without commissariat difficulties over districts which are now deserts.

The Arabic names of the valleys are names for trees, and there can be little doubt that at one time that the valleys abounded with the trees after which they are now called.

In Mr. Floyer's opinion this wholesale destruction of the arboreal vegetation of the region is primarily due to the camel and to the Arab. The first devoured the foliage; and the second converted the branches and trunks into charcoal. So long as the valleys were all the Arab had to depend on for feeding his camels so long did he preserve the trees. But by degrees the Arabs got a footing in the Nile Valley, and hired their camels to the farmers to carry their harvest.

They then went back to their deserted valleys and brought away the trees in the form of charcoal and thus the land was gradually laid bare.

What an excellent opportunity the Maltese people are missing for making known to the world at large the wares for which they are so famous in the manufacture.

Lace, and filigree work in precious metals constitute one of the staple industries of the islands, and it is surprising, considering the general depression which is manifesting itself among the working classes all over the islands, that steps have not been taken to further their interests and to promote a healthy emulation among their artisans by organising an exhibit for the Great World's Fair at Chicago.

On the 14th ult. the following notice appeared in the General Orders issued from head quarters, Valletta. "As it appears that certain ancient excavations have been discovered in the progress of Royal Engineer works, and the contents carried away contrary to the instructions issued on 30th of April 1888, the following order is published for future guidance. The District Commanding Royal Engineer will report immediately any discoveries of ancient tombs, burial places, or pottery that may occur in course of excavations for works, or come to light in any way. Such objects are to be carefully preserved until they have been inspected by an officer of the Civil Government, and in the case of ancient buildings, tombs, or burial places so discovered left untouched *in situ* until this inspection has been made."

The above notice has been issued in consequence of the depredations which have been committed among the newly discovered Phœnician tombs at Gebel Imtarfa. The manner in which, not these tombs alone, but also numerous other have been rifled of their contents by irresponsible curiosity hunters, and the state in which many of the ancient ruins of the islands now are, constitute a disgrace to European Archæological Science. More has been done to obliterate and destroy vestiges of Malta's ancient history during the last two centuries than was effected in the preceding two thousand years. In the time of the Knights they were shamefully neglected and maltreated, and even now, though laudable and energetic attempts have been made by a few enlightened individuals to protect and preserve some of the more precious of these relics, the majority are rapidly being dispersed through-out foreign countries, or are actually destroyed through being left to the tender mercies of the goat-herd, the farmer, and the tourist.

Correspondence.

MALTESE LEPIDOPTERA

Sir,

Valletta.

In one of the last numbers of the Mediterranean Naturalist, a wellknown collector of Lepidoptera remarks that several species of butterflies especially the *Vanessa Cardui* the *Colias Edusa*, as also the *Vanessa Atalanta* have this year been very plentiful.

Often when strolling about the fortifications outside Porta Reale I have seen numbers of the *pupae* of the *Vanessa Cardui* actually fringing the stony projections, and carefully hidden inside the holes and cracks of the old walls. Great quantities of these *pupae* were merely empty cases, the *imago* having already come forth.

The walls in the vicinity of these empty cases were splashed with tiny drops of blood that the butterfly emits immediately it leaves its case.

Others of these *pupae* were of a dark bronze colour and on further examination they proved to be lifeless. These seemed to have been killed by some other insect as they all had a slight puncture in one part or other of their bodies. I was

assured of this, when one day, I saw a pupa in the claws of a small yellowish spiler, that seemed to be sucking it; and as there were quantities of these spiders I concluded that the other *pupae* had met their death from a like cause. (1)

The *Vanessa Atalanta*, as I remarked before, has this year been extraordinarily plentiful. I have myself noticed numbers of them feeding on the canes in the valley near Casal Zebbug.

My attention was first attracted by seeing four or five dilapidated specimens of this beautiful butterfly fluttering about a cluster of canes. On closer inspection it appeared that not only butterflies but also bees were feeding on the juice of these canes.

I noticed that they were all clustered about the places where the outer bark had peeled off leaving the cane exposed, and that they were reluctant to leave the spot, returning to the same place when driven off. (2)

The *Vanessa Atalanta* seemed to thrive in these parts of the Valley, nearly all the specimens being of a good size; two that I captured measuring nearly 3 inches across the wings.

They appeared to be very strong on the wing, a short fat body and thick strong sucker and antennae.

(1) *The empty pupae are due to small parasitic Hymenopter? mostly of the Braconidae and Ichneumonidae which lay their eggs in the caterpillar, and the larvae of which feed on the pupa, rather than to spiders. The puncture commonly found in such pupae is the opening made by these minute flies, when after having killed and devoured the pupae they fly away leaving the empty involucre of the pupa. On walls in the country it is a very frequent occurrence to see dead or dying caterpillars of the Large Cabbage White (Pieris brassicae) surrounded by little yellow cocoons of these insects, the Microgaster glomeratus L.*

(2) *Vanessa atalanta has together with some other butterflies, e. g. P. aegeria the peculiar habit of returning after a short flight to the very same spot whence it has been scared. This is not only the case with flowers, but sometimes you see them reverting immediately to the same stone or leaf whence they had started so that in hunting for these species the best method is to wait until they come back to you by themselves. Other species on the contrary like Colias edusa when once they take to flight very seldom return to their starting point.*

A. C. G.

The *Papilio Machaon* never very rare in Malta has this year been very abundant; particularly so in the gardens situated in the higher parts of the islands, Boschetto for instance, and the gardens adjoining the Sanitarium at Notabile, where one morning in September last I captured no less than twenty nine perfect specimens.

There is one very peculiar feature in the *pupa* of this beautiful butterfly. The original colour of this is a light greyish brown, quite at variance with the caterpillar, which is of a beautiful vivid green with scarlet stripes.

But occasionally the *pupa* assumes a greenish colour (very much of the same hue as the cover of this paper) with pronounced yellow markings down its back. I have one such *pupa* before me as I write, the caterpillar of which was captured at Sliema and given me by a friend.

With regard to the Moths, some specimens appear to have been quite as plentiful as the butterflies, and others quite as scarce.

The *Cereocampa Celerio* for instance hitherto rather scarce has this year been comparatively numerous. I captured a fine specimen of it in August: when, as I was dining with a gentleman at Sliema it flew in at the open window and fluttered about the lamp.

The *Sphinx Convolvuli*, numbers of which I captured at the Railway Station at Notabile, where they were feeding on the four o'clock, better known by the name of "Hommeir" has been fairly plentiful; as also the *Deilephila Euphorbiae*, quantities of the *pupae* of which were taken in the vicinity of Boschetto.

Yours faithfully.

J. C. SCIORTINO.

TO CORRESPONDENTS:—Surg. Capt. Day. Floriana:—We cannot help expressing great surprise at your letter. You have now been receiving the "Mediterranean Naturalist" for eight months and since you refuse to pay for the copies, we must insist upon their immediate return.

Editor J. H. Cooke, B. Sc., F.G.S., Malta.



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NOTICES.

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To Correspondents.

We desire to notify our correspondents that when sending to us natural history specimens, or other parcels they should not send them through Messrs W. Wheatley and Co. of 10 Queen Street, Cheapside, London, nor through Messrs Turnbull and Co. of Strada Reale, Malta, nor through Messrs T. Smith and Co. of Str. Cristoforo, Malta.

22

The Fourth allotropic Form of Carbon.

In the January number of the *Mediterranean Naturalist* a fourth allotropic form of Carbon is described, possessing high metallic lustre, absolutely opaque, and free from ash, properties widely distinct from those possessed by Carbon in its other three well-known allotropic conditions, viz., the Diamond, Graphite, and Charcoal, or Soot. However, the discovery of this interesting form of Carbon is there attributed to Luzi—if indeed, he does not erroneously consider himself to be the discoverer—a statement which, seeing the high scientific importance of the *Mediterranean Naturalist*, it is absolutely necessary to correct in vindication of the rightful discoverer, Alessandro Cruto, of Piosasco (*Province of Turin*), as is clearly established by the Italian Patent he took out under the date of 7th March 1882, No. 167, entitled: *Improvements in electric lighting by incandescence, and in the manufacture of the Carbons, etc.*

I was so greatly struck with the absolute purity of this Carbon when brought to me for examination by Mr. Cruto, its magnificent metallic lustre, combined with its compact homogeneous structure, so widely distinct from any other form of carbon I had ever seen before, that I wrote an article on the subject, pointing out the beauty of the discovery, and the several advantages of the new product, which was essentially intended to be employed for incandescence lamps, and this appeared in a well-known periodical, the *Elettricità*, of Milan, so that, what with the patent and the article, every chemist has had the mean of knowing something of this fourth form of Carbon.

The process of its preparation is fully detailed in the specification, of which the following abridgment will be interesting. It consists in bringing hydrocarbons or chloride of carbon in contact with surfaces containing alluminous or alkaline

silicates at a temperature at which these compounds of carbon are decomposed.

Alessandro Cruto, the real discoverer, and a man of very fertile inventive genius, specifies two distinct methods of obtaining the carbon; either in very *thin lamelle*, or in the form of *wire*. In order to obtain the carbon in lamelle, he places a long porcelain tube, glazed internally, in an upright position in a furnace, in such a manner as to receive intense heat in its medial portion, which becomes incandescent. A gaseous current of either a hydrocarbon or a chloride of hydrogen is brought through a tube, provided with a cork or India-rubber stopper, fitting into the lower end of the porcelain tube. At the upper end of this latter is a sort of metallic cover, with an India-rubber connection, and with an aperture in it, to be able to watch the progress of the operation.

The bicarburet of hydrogen or other gas in passing through the highly heated zone of the tube is decomposed; in the case of the bicarburet of hydrogen this is resolved into protocarburet of hydrogen, which is evolved as a gas, and carbon, which adheres to the internal surfaces of the porcelain tube in the condition of uniform, brilliant thin lamelle. Thus obtained, the lamellae of carbon can be easily cut with a knife just like gold-leaf, and, moreover, they can be bent in the shape of the letter U without breaking.

When the carbon is required in the form of wire (as was applied by Cruto for incandescent lamps) he covers an extremely fine metallic wire with a very thin surface of one of the silicates mentioned above (1). This metal wire, being placed inside a glass tube, through which is brought a gaseous hydro-carbon, he passes a current of electricity through the wire sufficiently strong to decompose the gas, whereupon the carbon adheres to the surface of the wire, and possesses all the identical properties of that of the lamelle.

Turin, 3rd February 1893.

G. JERVIS.

(1) A few months later Cruto dispensed with the silicate coating, as superfluous.

The Natural History of Certain Fevers occurring in the Mediterranean

BY

SURG. CAPT. M. LOUIS HUGHES, A.M.S.

(Continued from page 327)

Having now described the fast growing bacillus of Enterica (typhoid fever) and the slow growing streptococcus of Mediterranean fever, I pass on to the third fever on the list, the proximate cause of which differs entirely from these, as it belongs more to the animal than to the vegetable class of parasites.

III. *Ague or Intermittent Fever*:—

This fever so common in Italy and other parts of the Mediterranean does not at present exist in an endemic state in Malta, though there is reason to believe that it formerly prevailed on the Marsa and in the valleys of Misida, Wied Emtalep and Wied Gineyna, before these lost their marshy character by being drained. The proximate cause of this fever, discovered by Laveran in 1880 and named the plasmodium or haematazoon of malaria belongs to the class of sporozoa or coccidia. As the organism has been found present in the blood of ague patients in France, Algiers, Germany, Austria, Russia, America, India and elsewhere, its presence is so easily demonstrated, it has such a peculiar relationship to quinine (the specific remedy for ague) and as it is not found present in the blood of patients suffering from other diseases, there can scarcely be a doubt that it is the true cause of the febrile condition termed ague or marsh fever. In the blood they present four different forms which in spite of the variety of their appearances constitute probably not different species of parasites but successive stages or states of the same polymorphous parasite and have according to Golgi definite relations to the access or variation of the clinical paroxysms of the pyrexia.

(a) *Spheroidal forms*.—These are the most frequent appearances and they may be seen as transparent, hyaline colourless amoeboid elements in the centre of the red blood corpuscles either singly or associated, to the number of even four. They are very small at first, but gradually grow until they completely fill the red blood

corpuscle, at the same time absorbing the pigment and depositing it in minute granules about their bodies often in a regular and circular appearance. These spheroidal bodies have the power of spontaneous amoeboid movement coinciding with a more rapid movement of the contained pigment granules. They continue to grow until finally becoming larger than a red blood corpuscle, they divide by segmentation and budding, the products of this process floating in a free state in the blood plasma.

(b) *Flagellated forms*.—In carefully prepared specimens of blood in which spheroidal forms are present in a free state, occasionally similar sized bodies may be seen possessing from 1 to 4 flagella with clubbed ends. These flagellated bodies are floating in a free state in the plasma. The flagella have no definite position and move independently of one another with great rapidity, communicating their movement to neighbouring corpuscles. Occasionally other flagella may be seen in a separate free state in the blood stream.

(c) *Crescentic forms*.—Bodies of the above shape, transparent and colourless—save for some pigment granules similar to those in spheroidal forms and situated midway between the horns—may be also found existing in a free state in the blood plasma. They do not adhere to the blood corpuscles as is often the case with the spheroidal bodies, not have they been observed within corpuscles, as is the case with coccidia of similar shape in animals (*Pepanidium ranarum*). They are not endowed with spontaneous amoeboid movement and the contained pigment granules are immobile. Intermediate forms between these spheroidal and crescentic bodies have been described, but their significance has not yet been proved.

(d) *Rosette forms*.—Side by side with the above forms spherical elements may occasionally be found in malarial blood under investigation, pigmented in the centre and regularly segmented. These by separation of parts may have some relationship to segmental reproduction.

Lifeless, irregular, pigmented amoeboid bodies are also occasionally present in the blood. Laveran found one or more of the above forms present in 432 cases of ague out of 480 investigations, (spheroidal in 389, crescentic in 107 and flagellated in 92 cases). Crescentic bodies were also present

in 95 out of 107 cases of cachexia or relapse. He believes that the small unpigmented bodies in the red blood corpuscles are embryos and that during their growth they produce the pigment granules. Later on they are endowed with amoeboid movement and live in a state of freedom in the blood plasma or adhere to red corpuscles on which they depend for nourishment. The flagella are developed in the interior of the spheroidal bodies and at a given moment are thrust out. The interpretation of the rosettes is doubtful but they are evidently related to the spheroidal and crescentic bodies.

Though artificial cultivation has not yet been successful, experiments have been made on birds, dogs, &c. and the disease has been transmitted from man to man by inoculation. It is not contagious but is the most prominent form of a miasmatic affection and never becomes a really infectious disease. It is a specific fever which needs suitable conditions of soil for its existence and can be introduced from without (like the potatoe and orange diseases) and flourish in a suitable soil not previously infected with malaria. Spore formation is not known but it seems highly probable that it is in this manner that it finds access to our bodies, either through the medium of drinking water derived from infected marshes or as a miasma arising from infected damp ground when undergoing a process of drying; in the former case by way of the alimentary tract and in the latter by way of the air passages. I do not wish to enter further into the wide subject of malaria, at present under discussion all over the world and will refer my readers to the works of Prof. Laveran, to which I am indebted for much of the information concerning this plasmode, and in whose works will be found a series of beautiful descriptive plates; (1) but would point out the close analogy of this parasite, attacking as it does the red cells of the blood, with that lately discovered parasite attacking the epithelial cells in cancerous diseases. I would in conclusion draw attention to a paper by Freire in the October number of the *Gazette Medicale de Paris* describing a micrococcus peculiar to the highly contagious and tropical yellow

(1) "*De Paludisme de son Hématozoaire*" par A. Laveran. 1891. Paris.

fever and bacillus special to the closely allied bilious remittent fever of cooler climates, thereby completing a series of closely allied fevers, two of which do not happily visit the Mediterranean.

I hope however that I have clearly proved the specific nature of Mediterranean Fever, and that even so small a beginning may lead in the future to a scientific and practical means of prevention, which by improving the salubrity of this island, would not only be a blessing to the residents and visitors, but add materially to its financial prosperity.

The Latest from Mars.

A summary of what we know about Mars, so far as its physical condition is concerned, appears in the conclusions drawn by Prof. W. H. Pickering from the observations made in Peru during the recent close approach of our most earth-like planetary neighbour. This astronomer finds it evident that the white caps covering the poles, and believed to be snow, are really a distinct phenomenon from the cloud formations. Clouds undoubtedly exist. They differ somewhat in density and whiteness from those of the earth, and they reach heights of not less than twenty miles. The atmosphere is inferred to be less dense than that at the earth's surface, but not as much as ten times less. The planet has two permanently dark regions, blue in color, that are presumably water. The other shaded portions undergo changes of colour not to be explained by clouds, being sometimes greenish and absolutely colorless at other times. Green regions are sometimes seen near the poles. Numerous so-called canals—some only a few miles wide—exist as described by Schiaparelli, but no conspicuous doubling was seen at this apposition. Branching dark lines run through the lighter shaded regions, and may mark river courses, though too wide for the stream themselves. An especially interesting observation was that of numerous black points scattered over the planet's surface, chiefly on the side opposite the two seas. Over forty of these points were discovered, nearly all at junctions of the canals diameters ranging from thirty to 100 miles. For convenience these spots are called lakes.

Meteorological Report for 1892.

We are in receipt of the "Results of Meteorological and Magnetical Observations" made at the Stonyhurst College Observatory during 1892, to which is appended the results of the Meteorological observations made at St. Ignatius's College, Malta.

An examination of the latter shows that the weather phenomena of the Maltese Islands during 1892 approximated very closely in its character to the average which has been experienced during the last ten years. The mean temperature for the twelve months was 63·3° Fah. with a mean daily range of 12·7° Fah.

The highest thermometric reading was recorded on the 2nd of August when the mercury showed 153·7° Fah. in the sun; whilst the mean temperature for the same month was higher than that of any other month of the year, being 78·4° Fah. The coldest months of the year were January and March when 38·2° and 38·0° were respectively registered.

Rain fell on 81 days of the year during which period 25·528 inches fell; hail fell on 5 days; thunderstorms were experienced on 22 days; and lightning was observed on 17 days. The wettest months of the year were January, May, September and November; 7 inches having fallen during November, and 3 inches respectively during each of the other months. No rain fell in August.

Appended to his report the Rev. J. Scoles S. J. records the results of his examination of the barometric waves during the last 10 years whereby he expected to be able to throw some light upon the interesting fact that so large a proportion of the gales that sweep over the islands last about three days, and also to find a difference between the Summer and Winter behaviour of the barometer.

Both of his investigations have been attended with gratifying success. We cannot do better than quote his own account of them. "I have reckoned the waves from Minimum to Minimum from a tabulation of the 8 a.m., and 8 p.m., readings, but eliminating movements or dips of less than one tenth, inch deep. The results are as follows:—

	Length in Days.	height in inches.	Rate of Motion in	
			inches per diem.	
January ...	6.3	0.400	0.135	
February ...	5.2	0.326	0.127	
March ...	6.0	0.379	0.128	
April ...	4.7	0.308	0.133	
May ...	6.4	0.268	0.080	
June ...	6.4	0.192	0.059	
July ...	7.3	0.180	0.050	
August ...	7.9	0.171	0.043	
September ...	8.5	0.237	0.059	
October ...	6.7	0.290	0.092	
November ...	5.8	0.276	0.096	
December ...	6.4	0.371	0.124	
Mean for Year	6.5	0.283	0.097	
Summer ...	7.2	0.223	0.064	
Winter ...	5.7	0.387	0.124	

SUMMER.

From this it appears that the depressions average $6\frac{1}{2}$ days in passing, and the winds of one side may be excepted to come near averaging 3 days in duration or sufficiently so to attract notice to the period. Very frequently we have only the winds belonging to one side of a depression, and generally it is the rising side that is windy. Comparing Summer half with Winter half, there is considerable contrast to be seen. The Summer depressions average 1.7 days more in length and 0.16 inch less in depth than the Winter ones, so that the motion of the barometer is twice as lively in the Winter half. April is a remarkable month for short period. In Summer, especially in June and July, when the weather is very fine, there is a constant difference between the 8 a.m. and 8 p.m. reading of from 3 to 5 hundredths of an inch in favour of the morning reading, the result of diurnal variation. This is seldom seen in Winter or indeed after August."

Geological Notes of Acireale

BY.

GAETANO PLATANIA

Following the coast one meets with springs of ferruginous water very rich in iron; which flow out from the rocks about one metre above sea level under the Timpa di Sta. Caterina, at a point almost inaccessible from the land side. A little

farther on is the Timpa di Tamaso, celebrated for the aerolite which was seen to fall there. Gradually the cliff diminishes in height as Capo Molini is approached, upon which rises the ancient and renowned tower called Sta. Anna, and near which was wrecked the British Eclipse Expedition of 1870.

Leaving behind the smiling coast, which according to legend was the site of the amours of Aci and Galatea, the furious jealousies of Polyphemus, and passing the Capo Molini we soon reach the Port of Ulysses so celebrated by the Homeric poems, as also the seven reefs and islands which the enraged Polyphemus was supposed to have hurled at the daring Ulysses. The largest of these reefs, is the island of Lachea; it is composed of columnar basalt, dolerite and a metamorphosed clay to which Gemmellaro gave the name of Cyclopite. This island is renowned for the large and beautiful crystals of Analcime, which can be collected there in great abundance, and which in consequence of their very limpid nature and such fine water have been utilized as gems. The Analcime is also found as salbands to the dykes of dolerite which traverse the clay, and as a crystalline crust on the latter where in contact with the dolerite. The same mineral is found sometimes in such extreme abundance as at the Faraglione Grande as have given the name of Analcimite to the Dolerite which was filled with it and which in consequence becomes a remarkable hard rock.

In the island of Lachea and in the other Cyclopean reefs are to be found many other minerals, as for example Pyrrhotite in crystals, Pyrites, Chalcopyrite, Hematite (specular), fine staleno-hedra of Calcite, granular Magnetite, rhombohedra of Dolomite, Siderite, Arragonite, Pyroxene with the variety Diopside associated with Anorthite, fibrous Tremolite of white, green and red colour, and Anorthite var. Cicoplite in flat tables (a mineral and not a rock), etc. (1)

On the eastern side of the island of Lachea are to be observed, at different heights above the sea level, bands of rocks covered by serpulæ and bored by lithodomi, which proves the recent eleva-

(1) I have also met with good crystals of Thompsonite,

tion of this reef, just as that observed at Palmarola by Dr. Johnston Lavis. (1)

The studies of Hamilton, Dolomieu, Spallanzani, Gemmellaro, Lyell and in fact almost everyone who has visited Etna, have advanced many theories to explain the formation of these rocks and have not yet exhausted the vast field of research which they offer to the naturalist, researches which render these reefs, already celebrated for the part they play in mythology, a sacred monument for the history of science.

The landing at Acicastello is beneath a cliff of globular basalt, which, like the neighbouring reefs, has also been studied by so many renowned geologists, is also rich in different minerals, and its peculiar structure has given rise to so many theories and hypotheses. Upon this cliff stands the historic ruins of the castle of Aci, glorious ruins that merit more care and preservation, and from whose walls one may enjoy a splendid panorama. By the side of the globular basalt projects a remnant of pelagonite tuff rich in beautiful zeolites. Amongst the most important minerals found in this tuff and in the basalt, the following may be mentioned, Chabasite in rhombohedrons, Garnet, Herschelinite, crystallized and globular, Phillipsite, and finally Mesotype which some mineralogists believe to be a mixture of Natrolite and Scolecite, an opinion not accepted by Von Lassaulx.

Leaving the coast we first notice a deposit of clay which extends northwards as far as Capo Molini, westwards to Nizzeti, and which southwards is limited by a recent lava that has surrounded different basaltic hills and even the rock of Aci-castello. This Post-pliocene clay (according to Lyell, earlier according to Gemmellaro) contains little bands of Augite. From the midst of this clay rises numerous basaltic hills, one more interesting than the other, and which present such variety of structure, such mineral riches as to offer a vast field for the study of the Vulcanologist.

(to be continued.)

Animal Plagues.

Many countries possess wild animals, snakes, or insects that are dangerous or troublesome to man. Some interesting particulars are given by Mr. P.L. Simmonds, F.L.S. In India 23,000 persons and over 68,000 cattle are killed by tigers, leopards, bears, wolves, and other carnivora, and in greatest proportion by snakes. Government bounty results in the annual killing of about 17,600 wild beasts and 578,000 snakes. Wolves have been troublesome in France, but the reward of £3 for each one killed is causing their rapid extermination. The Russian forests, in 1850, contained 170,000 wolves, which, together with bears, devour annually 200 children and travellers, 500 horses, more than 1000 oxen, and 4000 other domestic animals. In Austria 160 bears, 200 hyenas and 1200 wolves are slaughtered annually. Finland loses 5500 cattle each year by wolves. In Java 270 persons are killed yearly by tigers, and 180 by crocodiles. The locust is a dreaded pest in northern Africa, Cyprus, and other quarters, where it often brings famine. In Cyprus a bonus of £40 a ton is paid for destroying the eggs, and in some years 60 tons-equivalent to 4680 million locusts-have been destroyed. Australia has a liberal share of animal plagues. The kangaroos are an indigenous nuisance, each consuming as much grass as a sheep, and their numbers being so great that 10,000 a year for six consecutive years have been killed on a sheep run of 60,000 to 80,000 acres. The dingo or native dog is another foe of the settler, destroying many sheep. But the most formidable pest is the introduced rabbit, for whose destruction hundreds of thousands of pounds are now paid yearly, while the damage done amounts to millions. If undisturbed and sufficiently fed, two pairs of these creatures would in three years increase to the enormous number of 5,000,000. Victoria alone has 100 official inspectors and some 10,000 persons employed in rabbit extermination; while in New Zealand, which had not a rabbit twenty years ago but now exports 12,000,000 skins yearly, many colonists are thinking seriously of vacating the country with their flocks and herds.

(1) H. J. J. L.—*The Ponza Islands*.—*Geol. Mag.* 1819, pp. 529-535.

Notes and News.

The island of Samothrace has, according to an Athenian telegram, been visited by a severe earthquake the effects of which have been as destructive to property as were those of Zante.

In our next number we shall give our readers a detailed account of the more prominent physical phenomena with which the Zantiote earthquakes were accompanied.

About this time last year we had occasion to refer to the remarkable fact that many of the *most* destructive earthquakes of recent times have taken place in the month of February. Among others were noted the Lisbon earthquake in Feb. 1531; that of Aquila in Italy in Feb. 1703; the Sicilian earthquakes of 1783; the great earthquake in Central America in Feb. 1797; the Chilian earthquake in Feb. 1891; and now to these must be added the destructive earthquakes of Zante and Samothrace which took place during the early part of last month.

From the statistics that have been compiled it has been demonstrated that upwards of 60 per cent of the earthquakes that have been recorded, have occurred during the six colder months of the year.

The maximum number in January and the minimum number in July.

Such are the results of the calculations for the whole area of the globe. But the calculations that have been made for separate earthquake districts are in full accord with them, and in some cases show even a greater proportion for the cold than for the warm season. In the Mediterranean area this is especially the case as there the number of shocks that have been experienced during Dec. January and February are to the number felt during June July and August as 5. is to 2.

It is with the greatest pleasure that we are able to announce the appointment of our valued collaborator Dr. Johnston Lavis to the professorial chair of vulcanology in the University of Naples.

A magnificent specimen of the shark. *Lamna cornubica* or Smeriglio, measuring 14 feet 9 inches was caught by some Gozo fisherman off Cape Dimitri on the 12th of February last.

This species seems to be very abundant this year, many have been caught both in the tunny nets and with the line.

The Relationships of the Structure of Rocks to the conditions of their Formation.

BY

PROFESSOR H.J. JOHNSTON LAVIS M.D., B.S., FGS., ETC.

Again, we find pyroxene, antagonistic to olivine, amphibole, and biotite, competing for the magnesia. Again, in the Vesuvian pumices, amphibole and mica prevail, as these had probably formed under great pressure, whilst in the same pumices that escaped more slowly, and in the lavas, it is the pyroxene that monopolized the magnesia. We know that olivine (?), amphibole, and biotite are met with in their greatest perfection in plutonic rocks, whilst pyroxene is remarkably characteristic of rocks slowly cooled near the surface, and under low pressure. The fact of the former of these having resisted all attempts at artificial production points to conditions which have not yet been adopted in the laboratory, whilst leucite and augite are produced with ease and certainty. We therefore must conclude that antagonism of mineral species in crystallizing from a medium depends not only on the composition of that medium, but also of the surrounding physical conditions. Prof. Haughton (1) admits that, according to his theory, olivine ought to prevail, as it has only to contest for iron and magnesia, whilst pyroxene, amphibole and biotite, are weakened in the additional fight

(1) *Op. cit.*

for lime or alumina. He attempts to explain this by a theoretical principle which he calls that of *minimum paste*, which would not have been requisite had the physical conditions been taken into account. Again, this theory in its incomplete form is proved insufficient by the joint author, Prof. E. Hull, (1) in the same memoir, although it was undoubtedly a great step in the direction of an important principle.

M. Bourgeois (2) accounts for the crystals of pyroxene in leucite to be the crystallization of the glass cavities. This is obviously not the case, for the following reasons:—In the leucites of Roccamonfina and Vesuvius the crystals of pyroxene entirely traverse, project their ends on each side, whilst the leucite material is accurately moulded on the crystal facets of the pyroxene, which form leucite could not give to a glass space. Besides, many pyroxene crystals bear no relation whatever, either in size or position, to the remaining cavities, which themselves do not show such crystallization. Their crystals are often imbedded in the leucite mass, and project into a glass cavity, the latter portion being no thicker than the former, which was entirely enveloped in the leucite mass. Where much growth of crystals in glass cavities take place, that portion surrounded by the vitreous paste of the glass cavity should have increased in size. That the artificial conditions employed in the laboratory fairly represents the natural ones in the production of leucite there exists little doubt; the variations in temperature were just such as we meet with in the formation of that mineral at Vesuvius. Besides, the two minerals were identical in crystallographic characters, both externally and internally, as seen by polarized light, and also the great resemblance as exhibited in the strata of glass cavities.

That leucite may separate or any rate increase in size, after expulsion of lava, seems to be demonstrated by the observation of Scacchi, (3) that the scoria of the lava of 1855 did not contain large crystals, and that in the lava the distribution

of them was irregular, which seems to show that *recuit* at least increased their size.

In describing leucite I have considerably erred from the direct road, led on by the train of argument, based principally on the physical and chemical properties of this interesting mineral.

Biotite, though commonly met with in volcanic rocks, could not be obtained as a distinct form by Messrs. Fouqué and M. Lévy. In lavas we generally meet with this mineral in large, well-formed crystals, as also in pumices. In some basic pumices of Monte Somma (*Phase III.*) very beautiful hexagonal microlithic plates, and small crystals may be seen scattered throughout the magma, and often enclose crystals of orthoclase. In the more highly crystalline pumices and lavas this mineral occurs generally as well-formed crystals. Although it is not very uniform in its occurrence, I am disposed to regard it rather as pre-eruptive in formation, or at any rate, in part.

Magnetite is another mineral that cannot be obtained by simple fusion, but requires solution in a fused medium, from which it separates during cooling within a great range of temperature, (1) provided the formation of other minerals renders the magma supersaturated, from time to time, with this oxide, so that various crops of crystals may result, forming so many *periods of consolidation*. This is the only way we can explain its formation as with quartz, leucite, &c. Scheerer pointed out long ago the granite-forming minerals separated inversely to their fusion-points.

Pyroxene, as well known, is a common product in furnace slags, and is easily obtained by simple fusion of its elements with a very short *recuit*. Messrs. Fouqué and M. Lévy found it to be produced in a microlithic condition after a few moments' *recuit*, and prolonging this a little, fine crystals, such as are met with in volcanic rock, were obtained. Such a fact convinces us of the extreme rapidity with which basic pumices, at any rate, must have passed from the fluid to the solid condition, as in many of the Italian basic volcanoes the first products of some of their explosive eruptions were practically without even microliths of pyroxene, striking examples of which are to be met with in the deposits of *Phase, III.*, period 1,

(1) *Op. cit.*, p. 141.

(2) *Encycl. Chim.*, vol. ii., *Metalloids*, *Ier Appendice. Reprod. Artif. des Roches*, p. 212.

(3) *Guarini, Palmieri, Scacchi. Mem. Sul. Incend. Vesuv.*, 1855, p. 152.

(1) *Bull. Soc. Geol. 2e serie*, tom. iv. page 478.

and *Phase IV.*, periods 1 and 3, of Monte Somma. The above mentioned authors found the limit of temperature rather wide in which this mineral crystallized, which accounts for its inclusion in others that separate at rather higher temperatures. The pyroxenic glass seems to be the principal medium in which the other silicates and oxides are dissolved in basic rocks, whereas an acid felspathic glass seems to perform the same function in acid ones.

We may regard the magma from which results an igneous rock as a variable mixture of acids and bases, as pointed out by Abich. Now, as consolidation takes place, great excesses of either, especially the feebler ones, such as magnetite, are compelled to separate; and as the rock completes its crystallization, the excesses of either form the last crystals, unless the rock suddenly cools before all the vitreous matter has been converted into *formed* material. Thus, in the acid rocks we have quartz, and in the basic ones magnetite, being the last formed minerals, although the two most infusible of rock-forming minerals, which alone is sufficient to demonstrate that fusion-point has little or nothing to do with the order of separation of the minerals. We should therefore be more justified in determining whether a rock should be regarded as acid or basic by its microscopical structure, than by adopting 60 per cent. of silica as rigidly dividing the two, since the different bases vary much in alkalinity, and combining proportions, and a magma containing 60 per cent. of silica, might give an acid or an alkaline reaction, according to the quantities of different bases it contained.

Limit of space prevent further consideration of the different mineral species which go to make up igneous rocks; the above, being most common, are sufficient to indicate the line of argument followed out. Before, however, quitting the subject, there is one more point worthy of our consideration in relation to the separation of mineral species from a solvent. Different species have been easily obtained from fusion of their components in a saline substance, such as a chloride or sulphate. Thus, for instance, M. Lechartier (1) obtained pyroxene in crystals, a centimeter long, by fusion for a

couple of hours in calcium chloride, or sodium sulphate. In the same way wollastonite, apatite, (1) and many other minerals have been obtained by E. Behnen as very perfect crystals from solution in fused chlorides, and other salts, such as vanadates. These facts go to confirm what has been said about the solution of the more infusible silicates in the more fusible ones, and at the same time may account for the occurrence of some minerals that are eruptive, or post-eruptive, in time of their formation. The large amount of sulphates, but especially chlorides, that are vaporized during an eruption is hardly credible until a few facts convince us that such is the case. I have seen fumarole chimneys having in a short time their whole interior glazed by a mixture of chlorides, one to three centimeters thick, and from the intense heat as transparent as an ice covering, which was, without doubt, the result of sublimation, and not decomposition, as the rocks upon which it was deposited were quite unaltered. Another proof of the large amount of saline substances ejected by a volcano is the quantity met with in the falling ashes during a lava eruption. The outburst in 1872 produced an ash asserted by Prof. Palmieri (2) to be poorer in soluble constituents than any other since 1855, yet it contained from 4 to 9 per cent. of saline matter, chiefly sodic chloride. As this eruption was lateral, the principal part of the ash was derived from the crater edges and chimney walls, which would tend to lower the amount of soluble portion.

It was observed in the eruption of 1855 (3) that the alkaline chlorides were only evolved some time after the lava had been cooling—that is to say, saline crusts only formed around the fumaroles at a late date; and I have noticed the same thing. Scacchi supposed that it may be a spontaneous rise in the temperature in the lava in cooling, similar to that developed in phosphate of lead, nitrate of copper, or argentic (4) iodide when pas-

(1) L. Bourgeois, *Encycl. Chim.*, vol. ii., *Ier Appendice. Reprod. Artif. des Roches*, p. 10.

(2) *Annali del Reale Osserv. Meteor. Vesuviano* 1874, p. 73.

(3) Guarini, Palmieri, Scacchi. *Mem. s. Incend. Vesuviano del mese di Maggio, 1855, &c.*, pp. 141, 143, and 149.

(4) G. F. Rodwell, *Phil. Trans. R. S., Part iii.*, p. 1134.

(1) *Comptes rendus*, 1868, vol. Lxvii., p. 41.

sing from the amorphous to the crystalline condition. Or again, to their early union with other elements of the lava. This may possibly be so, the combination being broken up by a lowering of temperature (?), leaving the chlorides free to the sublimed. It seems to me that the chlorides must be continually escaping, but that they are not deposited until the scoria and fumarole sides are cooled enough to allow such to occur. The liquids included in cavities in crystals are generally solutions of chlorides or sulphates.

There is little doubt that these saline materials must form a very important constituent of the magma; but whether they play much part as a solvent medium for certain minerals is a thing yet to be experimentally verified, though one is inclined to think that they really do perform a very important function in that way. One point open to speculation is whether the presence of sodic and potassic chlorides and sulphates is not the determining cause as to whether the magma shall contain leucite hauynite, nosite, or sodalite. For instance, we find Monte Vultura producing at different epochs basalts, leucitic basalts and hauynite basalts, which might result from the accidental introduction of such salts from the sea or other sources. We might suppose the salts are decomposed and dispersed as acids, whilst the bases are seized upon by the silicic acid which, in a magma at high temperature, has powerful acid properties, and so forms minerals of the leucite or felspar groups.

In these papers I have brought together a considerable number of observations, and endeavoured to glean from them the clue to some of the most important problems of geological science. The train of argument is somewhat disorderly; but from the large number of circumstances that enter into the question of the formation of igneous rocks, the subject is difficult of arrangement. It is unmistakably evident that if the young science of petrology is intended to be carried beyond the simple dry description of rock masses, it must be brought to bear upon the various modifications and derivatives of them, in any given district, and also that it will never supersede field investigation; but by the two going hand-in-hand they may open the doors and show us the secrets of Nature's great chemical laboratory—our globe.

The Lands of Volcanoes.

In the Japan and Kurile Islands, according to Prof. John Milne, not less than 100 volcanoes still preserve their form and craters, and as many as 50 of them emit steam. The great eruptions which have been recorded number 238, the greater frequency, as with earthquakes, having been during the colder months of the year. One line of vents, more than 2000 miles long, begins in Kamschatka, and passes through the Kuriles, Yezo, and down by Honshiu to the ever-smoking Asama, where it is joined by a line running to the southwest through the great Fujisan and Oshama, till it reaches the Ladrões, a distance of 1200 miles. The last line begins near the gigantic crater of Mount Aso, and extends 1300 miles through Formosa to the Philippines. The lavas are all magnetic, and the soil of the country, consisting largely of decomposed lava, is in many places so filled with grains of magnetite that a brush of this material will be collected on a magnetized knife scraped over a garden walk. The most famous of the volcanoes is Fujisan. On its summit, at a height of about 12,400 feet, Prof. Milne has made observations with a tremor-measure that tend to prove that the great mass of the mountain is actually swayed by the wind!

The Geology of Arabia Petrea and Palestine

At a recent meeting of the Geological Society of London a paper entitled, "Outline of Geological Features of Arabia Petrea and Palestine," by Prof. Edward Hull, LL.D., F.R.S., F.G.S. was read, of which the following is an abstract, taken from the "Proceedings of the Geological Society of London."

The regions may be considered as physically divisible into five sections, viz. :—(i) The Mountainous part of the Sinaitic Peninsula; (ii) the table land of Badiet-el-Fih and Central Palestine; (iii) the Jordan-Arabah valley; (iv) the table-land of

Edom., Moab, and the volcanic district of Jaulân and Haurân; and (v) the maritime plain bordering the Mediterranean.

The most ancient rocks (of Archean age) are found in the southern portion of the region; they consist of gneissose and schistose masses penetrated by numerous intrusive igneous rocks. They are succeeded by the Lower Carboniferous beds of the Sinaitic peninsula and Moabite tableland, consisting of bluish limestone with fossils, which have there counterparts chiefly in the Carboniferous Limestone of Belgium, and of a purple and reddish sandstone (called by the Author 'the Desert Sandstone,' to distinguish it from the Nubian Sandstone, separated from the Cretaceous age), lying below the limestone. The Nubian Sandstone, separated from the Carboniferous by an enormous hiatus in the succession of the formations, is probably of Neocomian or Cenomanian age, and is succeeded by white and gray marls, and limestone with flint, with fossils of Turonian and Senonian ages. The Middle Eocene (Nummulitic Limestone) beds appear to follow on those of Cretaceous age without a discordance; but there is a real hiatus notwithstanding the apparent conformity, as shown by the complete change of fauna. In Philistia a calcareous sandstone in which no fossils have been observed is referred to the Upper Eocene; for the Miocene period was a continental one, when faulting and flexuring was taking place, and the main physical features were developed—*e.g.*, the formation of the Jordan-Arabah depression is referable to this period.

In Pliocene times a general depression of land took place to about 200-300 feet below the present sea-level, and littoral deposits were formed on the coasts and in the valleys. To this period belong the higher terraces of the Jordan-Arabah valley. The Pliocene deposits consists of shelly gravels. Later terraces were formed at the epoch of the glaciation of the Lebanon Mountains, when the rainfall was excessive in Palestine and Arabia.

The volcanoes of the Jaulân, Haurân and Arabian Deserts are considered to have been in active operation during the Miocene, Pliocene, and Pluvial periods; but the date of their final extinction has not been satisfactorily determined.

The vegetation of the house terraces of Malta.

Every body who lives or has lived in Malta has doubtless observed our characteristic oriental looking flat-topped houses. These afford capacious terraces whereon rain water collects and is afterwards conducted along their imperceptible slopes by means of clay pipes into our wells. All these terraces and generally also the walls which surround them do not keep their original colour but are often encrusted with lichens which after a rain shower exhibit themselves as layers of black, grey and yellow patches, contrasting with the deep green of the mosses and algae, which find favourable conditions for growth in the wet ground.

Besides these, there are certain phanerogams so urban in their habits that they are very often found on the cornices of the terraces or in protected corners. These are for the most part, as would be expected, plants the seeds of which are transported by the wind or by birds.

Botanists go far into the country in search of flowers and interesting plants whilst they have an unknown vegetation growing over their heads, which has been altogether neglected till now. Though these humble plants cannot boast of a brilliant foliage or of pompous corollas they are not the less interesting, and uncared for they deserve not to be simply throdde upon.

These lichens are an important factor in rendering our houses damp proof, for they coat our limestone which is so much subject to atmospheric influences with a protective layer, which effectually prevents it from absorbing too much water in winter and from the direct action of the sun rays in summer.

The number of species usually to be found does not vary much, nor it is very abundant.

To begin with the higher forms, the phanerogams generally met with in corners or on the cornices are:—

Konigia maritima Br.

Polycarpon tetraphyllum L.

Conyza ambigua D.C.

Sonchus asper Oll.

Picridium vulgare Desf.
Chenopodium urbicum L.
Trisetum condensatum Sch.
Sclerocla rigida Lk.
Poa annua L.
 On walls we find:—
Reseda alba, L.
Phagnalon rupestre D.C.
Antirrhinum siculum Etc.
Nicotiana glauca Gr.
Parietaria officinalis L.

In the country I have seen on terraces many other plants, but I am only mentioning those which are of the commonest occurrences.

Of mosses the species which is constantly seen on all terraces is *Barbula muralis* Hedw in its two forms *incana* and *aestiva*; it begins to come in fruit in January.

Among the commonest lichens on terraces I have noted:—

Psorotichia murorum Mass.—which is the first to appear on walls looking to the North.

Placodium circinnatum Pers.
Lecanora sulphurea Schaer.
Ricasolia Gennari Bgl.
Ricasolia Cesati Mas.
Amphiloma callopisma Ac.
Collopisma luteoalbum Mass.
Aspicilia calcarea L.
Verrucaria controversa Mass.

Lastly those green expansions generally seen in the more moist places are due to the presence of algae, of which the commonest are:—

Pleurococcus tectorum Trev.
 „ *vulgare* Menegh.
Protococcus viridis Ag.

DR. ALF. CARUANA GATTO.

Science Gossip.

An instructive map of North Germany, showing the distribution of forests and the most common species of trees during the Middle Ages, has been prepared for a geographical journal by Dr. Ernst

H. L. Krause. The work has been accomplished chiefly by the consultation of old records, and the examination of forest remains and ancient trees. The increase of population and farm cultivation may be strikingly shown by comparing such a map with one of modern vegetation.

From statistics of many years, Dr. P. J. Kolski finds that, though the weather may not be the main cause of kroupous pneumonia, as was formerly believed, it plays a not unimportant part in the development of the disease. Abnormal weather in general has an influence. In Moscow the most favorable conditions for the prevalence of pneumonia seem to be a low temperature with slight daily variations, abnormally high barometric pressure, a north wind of less than usual force, and a small amount of rain or snow. High winds and much moisture, contrary to general belief, do not favour pneumonia.

At Bushire, on the Persian Gulf, an extreme temperature of 180° is said to have been recorded. Shikarpur, India, at times has no place cooler than 140°, and at Sukkur the lowest temperature is 97°. Here hot winds from the desert are sometimes so terrible as not only to kill everything in their path, but even to burn up tissue and cartilage. The Russians claim that Central Asia has places even hotter than these. In the southwestern United States temperatures of 130° and 140° are not uncommon.

A study of the records of the last ten years has shown Habenicht, of Gotha, some unmistakable coincidences between the frequency of icebergs in the Gulf Stream and the weather in Europe some six months afterwards. The number of icebergs reported has varied from 10 in 1888 to 674 in 1890. The iceberg minimum of 1888 was followed by the warmest year of the series; and the remarkable maximum of 1890 was followed by the coldest winter and spring known for twenty years.

The cultivation of sunflowers in Russia was begun in 1842 at Varonezh. The industry has proved so profitable that in 1881 not less than 367,800 acres had been given up to it, and in 1887 the area planted had increased to 704,500 acres. The chief product is the oil from the seeds. The

residual cake has considerable value and is in constant demand from abroad, while the shells or husks of the seeds, as well as the stalks of the plants, are useful for fuel.

The blood of animals has been used for bread-making by Dr. Makarof in Russia. A dough of $2\frac{1}{2}$ parts of rye meal and $1\frac{1}{4}$ of blood, is baked into a very good loaf, which is more nutritious than ordinary bread of rye or wheat. It is suggested that those who slaughter animals be required to collect the blood, which has hitherto been wasted, and forward it to specified centres, where it should be made into bread and distributed to the poorer peasants.

There are twelve persons in a hundred, according to Bleuler and Lehman, who have the faculty of hearing colours, and 500 cases in all have been well authenticated. A very curious illusion of these people is that up to the moment of being questioned they are convinced that this faculty of attributing colour to sounds is natural, normal, common to every one, and it is not without uneasiness that they learn the contrary. The faculty is most common among the cultured. In considering its origin, M. Alfred Binet suggests that perhaps some importance should be attached to the little reading books in which the letters are coloured for children; and that perhaps, also, the sound of certain words which designate colored objects is detached from the word itself by sort of abstraction, and carries with it the reflection of its colours to other words.

A tenant of more than ordinary interest has lived in the Garden of Plants, Paris, since August, 1885, and has been an object of study by M. Vaillant. This is a South American boa (*Boa murinus*) at least 20 feet long. Up to the end of 1891 the serpent had taken food in this place 34 times, an average of five times a year, the interval between its meals ranging from 28 to 204 days. It calls for its meals by characteristic uneasiness. Its usual food has been small goats, with rabbits on three occasions and a goose on one, and the largest animal it has swallowed has been a kid of 26 pounds, or about one tenth of its own weight. Such prey is not of remarkable

size, as serpents are capable of swallowing animals nearly as large as themselves. A few years ago, indeed, a horned viper was caught in the act of swallowing a French viper a little larger than itself, and no ill effects followed this enormous meal.

Researches of Suchsland show that the process of "sweating" to which tobacco leaves are subjected in preparing them for use gives rise to fermentative changes that are not due to purely chemical action, as has been supposed, but are effected by micro-organisms. The species vary in different kinds of tobacco. But what is most important is that pure cultures of the bacteria have been made and with them it has been found to be possible to transfer the peculiar taste and aroma of one kind of tobacco to another kind, and thus to raise the quality of inferior grades. Other German investigations during the last few months prove that the character of wine varies with yeast employed. As the qualities of butter and cheese depend also upon micro-organisms, is it not possible to improve dairy products as well by inoculation with cultures of carefully-selected bacteria?

Among the Laos, a people inhabiting a district of Siam, the chewing of a preparation called "meing" is almost universal, the practice being especially esteemed by those whose labour brings great bodily fatigue. Recent inquiry shows that this delicacy is prepared from the Assam tea-plant of commerce. The leaves, instead of being used for an infused beverage as in other countries, are steamed, tied into bundles and buried in the ground for about 15 days, after which the product will keep for two years or more. A similar use of tea is not wholly unknown elsewhere. Good authority states that, even in European countries, the ordinary dried leaves are sometimes eaten, a craving being gradually established as in tobacco-chewing.

Undoubtedly the strongest vessel of its size in the world is that now being finished in Norway for Dr. Nansen's Arctic expedition. It is built of long-seasoned materials, and the frame timbers are so close together that the vessel would be water-tight with the planking stripped off. The

planking is, first a ceiling of pitch-pine, alternately 4 and 8 inches thick, then outside two layers of oak, 3 and 4 inches thick respectively, and over all is an ice-sheathing of greenheart. The sides are thus from 28 to 32 inches thick of solid wood. The vessel is sharp and iron-clad fore and aft, and its form ensures pushing up out of water as the ice closes around it. Both propeller and rudder may be lifted in wells to avoid ice, while in action the rudder may be immersed beyond the reach of floating ice. The length of keel is 101 feet, deck over all 128 feet, breadth of beam 36 feet, and depth 17 feet. The vessel is rigged as a three-masted schooner, and has an engine of 160 indicated horse-power. With carefully selected equipment for five or six years, it is Dr. Nansen's intention to sail next June, and to seek and follow the ocean current that is believed to cross the polar basin from the New Siberian Islands towards the north of Greenland.

A case of bleeding through the sound skin is the subject of a European medical report. A girl of eighteen was the sufferer, the blood appearing from the tip of the nose, from the anterior surface of the fore-arms, and from the finger-tips. At times the blood simply oozed through the skin, then spurted a foot high, the phenomenon lasting, with short intermissions, about four hours. The usual symptoms of exhaustion followed. The girl had been in good health, and repeated examinations failed to reveal any adequate cause for this singular hemorrhage.

A mollusc that might take an important place in textile industries if it existed in sufficient numbers, is found in warm seas, especially on the coasts of Sicily and Malta. It is the *Pinna*, a genus of wingshelled bivalves, of which one species attains a length of two feet. To attach itself to the rocks it spins a cable of strong filaments, called collectively the byssus. These threads are wonderfully strong, silken in texture, and have been woven into various delicate fabrics. A pair of gloves from this material may be seen in the British Museum, and fine mummy cloths made from it by the ancients are still preserved.

Perfumes and the odours of flowers are not be relied upon to take the place of ordinary disinfectants, yet they may play a considerable part in strengthening our defence against disease germs. A German chemist, Herr Omeltschenk, has been making experiments to determine the activity of certain essential oils as germicides, and finds that oil of cinnamon has the greatest effect and oil of rose the least, while oils of fennel, lavender, cloves, thyme, mint, anise eucalyptus, turpentine and lemon range between. The bacillus of typhus was killed in 45 minutes in air carrying the vapour of oil of cinnamon in the proportion of 0,0005 gram per liter. The bacillus tuberculosis was destroyed in 23 hours by cinnamon vapour of the strength of 0,0018 gram per liter of air; in 12 hours by oil of eucalyptus in the proportion of 0.0252 gram per liter of air; and in the same time by oil of lavender in the proportion of 0,0018 gram per liter. Constant renewal increases the activity of the vapors, which in small proportions seem to exert a retarding influence on the growth of germs.

The oldest herbarium in Europe is scarcely 400 years old, but in the Egyptologist Museum at Cairo is a collection of parts of plants that have been collected from ancient Egyptian graves and carefully investigated by Dr. George Schaweinfurth. There are both the edibles made necessary by ancient beliefs and the symbolical floral offerings. The funeral food of the fifth dynasty (3000 B. C.) include a well-preserved legume of clover and a handful of barley; that of the twelfth dynasty (2500 B. C.) grains of mustard seed, capsules of flaxseed, gourds, lentils, beans, figs, pine needles, juniper berries, etc.; and from later graves have come onions, leeks, garlic, and such flowers and plant decorations as the blue and white lotus the red poppy, oriental larkspur, hollyhock, crown chrysanthemums, safflower, pomegranate flowers willow leaves, grasses, etc. The richest finds have been yielded by tombs of the eighteenth to the twelfth century B.C. One of the general conclusions to be drawn from this herbarium, says Herr Paul Pasig, is that Egypt has sustained no appreciable climatic changes during the last 4000 years.

If the inferences of Lord Kelvin be true, it may be necessary to discard the favorite idea that magnetic storms, or disturbances of the earth's magnetism, are connected with sun-spots. The sun and the planets are probably all permanent magnets—the sun much the mightiest of all. But if meteoric impact, or any other possible dynamical action within the sun or in his atmosphere, produced, for example, the terrestrial magnetic storm of June 25, 1885, the recorded changes indicate that the agent must have worked at something like 160 million million million horse power, which is about 364 times the total horse-power of the solar radiation. Thus, in the eight hours of a not very severe magnetic storm, as much work must have been done by the sun in sending magnetic waves out in all directions through space as he actually does in four months of his regular light and heat. This seems to show conclusively that magnetic storms do not depend upon the magnetic action of the sun. The investigations of Schuster have proven that the disturbance is not within the earth, and it is certainly evident that the aurora above the surface and the earth currents below are in full working sympathy with magnetic storms. While these facts are known, however, we are far from having any satisfactory explanation of any of the marvellous magnetic phenomena of the earth.

A French writer attempts to trace table utensils—most of them of recent introduction—to their origin. The Romans took their meals lying upon very low couches, and it was not until about the time of Charlemagne that a stand was used, around which guests were seated on cushions, while the table made its appearance in the middle Ages, and with it came benches with backs. The Greeks and Romans ate from a kind of porringer, yet during a portion of the middle Ages slices of bread cut round took the places of plates. The spoon is very ancient and many fine specimens are in existence that were used by the Egyptians in the seventeenth century B. C. The knife—though very old—had not come into common use as a table utensil in the tenth century. The fork was absolutely unknown to the Greeks and Romans, appeared only as a curiosity in the Middle Ages, and was first used upon the table by Henry III. Drinking cups—in the Middle Ages, made from metal, more or less precious—naturally date from the remotest antiquity. The use of glasses from Venice, began to be general in the fifteenth century. The salt-cellar appeared at a very early date, and occupied the place of honour at the banquets of the Greeks and Romans, many of them being of gold and silver. The castor is probably not older than the sixteenth century.

Metereological Report.

Lat. 35° 55' N.

Long. 14° 29' E.

Barometer Readings reduced to 32° F. at sea level.

ST. IGNATIUS' COLLEGE

MALTA.

January 1893.

Results of observations taken during the month.

								Average
								10 years
Mean Reading of Barometer	...	...	...	...	...	inches	29.851	30.056
Highest „ „ on the 31st	...	...	...	...	...	„	30.379	30.425
Lowest „ „ on the 24th	...	...	...	...	...	„	29.416	29.578
Range of Barometer Readings	...	...	...	...	...	„	0.963	0.847
Highest Reading of Max: Therm: on the 10th	...	...	...	...	...	„	65.4°	64.9°
Lowest Reading of Min: Therm: on the 19th	...	...	...	...	...	„	39.0°	41.8°
Range of Thermometer Readings	...	...	...	...	...	„	26.4°	23.1°
Greatest Range in 24 hours on the 19th	...	...	...	...	...	„	18.1°	18.4°
Mean of all the highest Readings	...	...	...	...	...	„	57.7°	59.0°

Mean Daily Range	...	...	...	...	...	...	11.1°	10.4°
Mean Temperature (deduced from Max: and Min.)	...	...	...	...	...	...	51.4°	53.1°
Mean Temperature (deduced from Dry Bulb.)	...	...	...	...	...	...	50.8°	52.9°
Adopted Mean Temperature	...	...	...	...	...	...	51.1°	53.0°
Mean Temperature of Evaporation	...	...	...	...	...	...	46.8°	48.7°
Mean Temperature of Dew point	...	...	...	...	...	...	43.8°	45.6°
Mean Elastic force of Vapour	...	...	...	...	...	...	0.286	0.306
Mean Weight of Vapour in a cubic foot of air	...	...	...	...	...	grains	3.3	3.5
Mean additional weight required for saturation	...	...	...	...	...	...	0.8	0.9
Mean degree of Humidity	...	...	...	...	...	...	81	80
Mean Weight of a cubic foot of air	...	...	...	...	...	...	540.9	542.5
Fall of Rain	...	...	...	...	...	inches	6.643	3.594
Number of days on which Rain fell	...	...	...	...	...	...	20	13
Mean amount of Cloud (an overcast sky = 10)	...	...	...	...	...	...	5.7	5.0
Total number of miles of Wind indicated	...	...	...	...	...	...	847.9	850.0
Mean Velocity of Wind per hour...	...	...	...	...	...	miles	11.4	11.4

REMARKS

Dew Point: ranged between 54.0° on the 11th and 29.0° on the 23rd.

In Sunshine: the highest reading was 106.5° on the 19th.

On Ground: the lowest reading was 36.5° on the 6th.

Thunderstorms passed on the 4th 13th and 16th.

Hail fell on the 2nd, 3rd, 4th, 5th, 17th, 18th, 22nd and 24th.

Total Rainfall since last June 21.386 inches; the average of 5 years, 14.795 inches.

Pressure has been unusually low and rainfall nearly double the average.

2nd February 1893.

(Signed) JAMES SCOLES S. J.

Correspondence.

EXCESSIVE CHARGES

Valletta, February 26th 1893.

Sir,

Many have been the complaints that have lately been made of the excessive charges of carrying companies for the transport of parcels from the United Kingdom to these islands, and equally numerous have been the complaints made of the extortionate demands of certain agents in this city for the landing of the packages that have been consigned to their charge.

It appears to be a common practice, even after high rates of charges have been paid in England for transport, for the unfortunate consignee to be fleeced by certain agents here of sums representing 300 and 400 per cent over and above the actual disbursements made by them for what they are pleased to call landing charges, &c; (the &c does not include delivery charges) and in cases where the whole of the charges have been forward-

ed for collection from the consignee, really startling sums, the amounts of which are out of all proportion to the size or value of the package, are demanded. So grave an evil has this become that many firms in Malta have given up their agencies rather than countenance such reprehensible and unconscionable methods of doing business. There is, however, no redress for the victims.

Having been sharply bitten upon several occasions by these gentry I should esteem it a favour if you would give publicity to this letter in order that it may serve as a warning to the public.

Yours faithfully,

M. J. RUSTON.

(We can fully endorse the statements made by our correspondent. We shall have more to say on this subject in our next issue. In the mean time we would advise our correspondents to send their parcels through the Parcel-post, through the P. and O. agency, or through Messrs Morgan & Co. of Fenchurch St. London. Ed. M. N.)

Editor J. H. Cooke, B. Sc., F.G.S., Malta.



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"	" Port Said	13	10	}...20% reduction, returning within 4 months			
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The Mediterranean Naturalist.

A Monthly Journal of Natural Science. Subscription 5/- per annum.

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NOTICES.

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Special Notice.

Back numbers may be had price one shilling each.

Contributors may have duplicate copies of their papers upon application to the Editor.

To Correspondents.

We desire to notify our correspondents that when sending to us natural history specimens, or other parcels they should NOT send them through Messrs W. Wheatley and Co. of 10 Queen Street, Cheapside, London, nor through Messrs Turnbull and Co. of Strada Reale, Malta, nor through Messrs T. Smith and Co. of Str. Cristoforo, Malta.

Important Notice to our Readers.

We desire to inform our readers that is our intention to enlarge the Mediterranean Naturalist, and, from time to time to illustrate it.

Instead, however, of publishing every month as heretofore, we shall publish every two months.

The Recent Earthquakes in Zante.

by

W. G. FORSTER.

Seismologist, Manager, and Electrician, Eastern Telegraph, ZANTE.

From the traditions of the place it has always been considered pretty certain that Zante must invariably expect a more or less severe earthquake about every thirty years. I find however that this cycle of Seismic disturbances is common to all earthquake districts in South-Eastern Europe and Asia-Minor and that there exists also a fairly proven and established law which governs these periods of visitation, for instance, whenever any long time has elapsed without the slight shocks—which average one or more a week in earthquake districts of non volcanic regions—and when to these periods of comparative quiescence succeeds one of constant earth tremors then a disastrous shock is nearly certain to take place. This is a very important point and cannot be neglected when the question as to the origin of the shocks is under consideration.

The last strong local earthquake previous to the present series of shocks occurred on the 26th October 1873 and although it was far less severe, it originated within a mile or so of the present one's centrum, as proven by a knot of submarine cable having been then lost, buried under the immense mass which fell into it, at the bottom of the sea; and by the measurements taken at the time.

This earthquake had precisely the same characteristics as the present one, both previously and subsequently to its occurrence and although very many severe and slight shocks have been felt since

1873 in no case were they of so pronounced a local nature as those just recently experienced. When the great earthquake of August 27th 1886 occurred, which destroyed Filiatra on the Mainland to the South-east of Zante, this island was fortunately outside the direct vibrative waves of seismic forces radiating from the centrum of that shock; which covered up six knots of Submarine cable in Lat: $37^{\circ}.25$, Long: $21^{\circ}.11$ east of Greenwich; but still it did considerable damage and its force was severe enough to cause the greatest alarm even in so distant a place as Malta.

From that year until the spring of 1890 there were numbers of small shocks but after then and up to August 1892 only a very few tremors were recorded. On August 16th last year about 12 small shocks suddenly occurred during the day, purely local, and all from East to West. After three days of absolute tranquillity they began again and although merely pulsations they were of a very pronounced character.

At midnight on August 27th the shock was strong and from then until the still smarter shocks of September 3rd and 5th the earth seemed always shaking. Another few days of quiescence were followed by a renewal of shocks. This state of things continued until the middle of January last—and was again succeeded by a fortnight of perfect tranquillity. At 9 p.m. on January 30th a very distinct rumbling occurred which was followed by a short, sharp shock as if from some falling mass, and then all was still again. I noticed after this shock a series of small ripples on the sea which was previously and subsequently quite calm. The night passed very quietly until 5.34 a.m., local time, when the whole island began to sway terrifically from East to West with a purely undulating motion finishing up by a movement which I can only describe as being similar to that of some mighty force wrenching out the bowels of the earth. This shock lasted twelve seconds and its centre was undoubtedly in the sea very close to the town and due east of the same. From its apex of origin its range of destruction, on the frontage of the town, was not wider than two miles spreading out to about fifteen when it reached the villas at the base of the range of hills, six miles off.

The destructive force had a tendency to incline from due East to the North West of the island

which is about 27 miles in length by an average breadth of eight, a subsequent shock taking a much lower range. During the whole day shocks were alarmingly frequent and numbered some hundreds between the first and nightfall when every body went to the open ground in a most panic stricken condition. At 1.56 a.m. on February 1st another terrific shock took place—not so severe as the first but with a range towards the southwest and of increasing destructive force. This shock lasted 20 seconds and was also succeeded by numberless others. After 23 hours a third severe shock occurred and periodically during the whole week others, of decreasing intensity took place. Since the first shock until the present date, at least one thousand (including pulsations and tremors) have been felt.

Of course the direct and indirect damage has been very great owing to the extensive zone of destruction, the scattered nature of the villages and to the bad construction of the houses in general and to their dilapidated condition owing to extreme poverty of the island. At least half a million sterling is required to rebuild the place and as this amount can never be realized many of the ruins are likely to remain untouched and most of the population will have to emigrate.

In considering the question of earthquake origin it is necessary to bear in mind that all seismic disturbances must be divided into two distinct classes that is to say, earthquakes in the immediate vicinity of active volcanoes preceeding or subsequent to an eruption, or where Volcanic agency can be clearly traced as influencing their distribution, and into quakes originating in non-volcanic districts.

To the latter class belong the periodical shocks which cause such disaster in Zante and in the various other non-volcanic Turco Hellenic regions.

Before dealing however with these I propose to show that although the attendant phenomena and frequently the effects are the same in both classes, very different laws govern their motion and duration. In the first place the earthquakes due to volcanic action have a very limited range indeed they are only felt in the immediate vicinity of the volcanoes themselves. This is explained by the fact that the detached masses, the slipping away of rocks and earth from the sides and cone of the

craters, due to the contraction of the crust from the heat generated by the rapidly rising lava, constitute a purely superficial seismic wave propagated into the surrounding region upon its surface, and barely extending beyond a few miles from its point of origin. This is especially noticeable with Vesuvius, Etna, and the volcanoes of Japan. As an example we have only to take the great eruption of the Bandai-san volcano in Japan on July 15th 1888 which was attended with such serious loss of life.

Although the effects of this eruption were terrific and the earthquake shocks of great intensity the shaken area was limited to a radius of 25 miles beyond which nothing was felt. In moderately strong shocks occurring in non-volcanic zones the radius is rarely less than 100 miles. Again volcanic earthquake shocks are more frequently vertical than undulating, where as non-volcanic ones are in an inverse ratio. The former have no fixed periods of occurrence nor do any shocks occur unless an eruption is imminent the latter however have a law which governs the periodical visits of the very violent shocks and small ones are continually felt even during the so called period of quiescence. The earthquakes which precede an eruption may almost be said to accompany it. In the Bandai-san case, the first shock occurred at 7. 10 a.m. a more violent one at 7. 30 lasting 20 seconds and a third still more violent a few minutes afterwards which lasted 70 seconds and was immediately followed by the bursting open with terrific force of this assumedly extinct volcano the last previous explosion of which had taken place over 1000 years before. Now from all the records and traditions of disastrous earthquakes in non-Volcanic centres warning shocks take place at least two months—frequently more but never less—before the great one happens. These shocks are of daily occurrence and of varying force, except just before the big quake when there is invariably a period of absolute quiescence. When this big shock does take place it is followed by an immense number of others, often very strong but never stronger than the first, and eventually these die out and the several districts return to their normal condition of periodical small disturbances many other examples could be given to prove the existence of these two distinct classes of earth-

quakes but space will not permit their consideration, at least in this paper.

In attempting to establish a theory as to the real cause of non-volcanic earthquakes particular attention must be given to actual facts, confirmed details and some logically substantiated support of the assumed deductions which have been arrived at. To talk of the existence of molten "lava streams" moving under the upper-crust of the "earth" the "interconnection between volcanoes and far off earthquake centres," "the influence of the moon in certain phases; sunspots and meteorological anomalies" simply bewilders the student and diverts the research into false channels. We accepted Laplace's theory of central fire in lieu of a better; and we believed our world to have been constructed from the same in its process of cooling; but today we find every thing tending to disprove this and to attribute our planet's existence to Light alone. "*God said Let there be Light and there was Light*" and hence our planet. To assume that volcanoes are the vent-holes of the plausibly doctrinal hypothesis of central fire is as irrational as asserting that thermal springs also originate in the bowels of the earth instead of near its surface, and to pretend that the sun, moon, or atmosphere could possibly cause one microscopical spot of the whole globe to rock and sway as Zante has recently done is pure nonsense, and as inadmissible as if we assumed earthquakes to originate supernaturally.

That all seismic disturbances originate on the surface of the earth or but a few feet below it must be admitted when the whole question has been thoroughly considered.

Were it otherwise the range of destructive motion-acceleration would be enormous and not confined to a score of miles or so.

Of non-volcanic earthquakes 90 % at least originate in the sea and the remainder by subsidence, erosion by underground rivers, and the chemical action of an anomalous subsoil &c. Who ever thinks of attributing the great Lisbon earthquake to anything else than an immense subsidence due to a honeycombed foundation—which to judge from the anomalies of the sea's bottom, the currents of the river Tagus, and many other attendant phenomena—constitute still a standing menace to that great city. At Casamicciola we

had the greatest proof of the effects of erosion from mineral waters acting chemically & mechanically upon the soil below the doomed town, and the same forces are still at work on the bottom of the sea and on land wherever an earthquake centre exists.

In 1887 and 1890 I wrote papers upon earthquake origin with the object of proving that by the aid of submarine telegraphy a new era had opened for the development of seismological research. Both previously and subsequently many facts have occurred to support the accuracy of my deductions and *prima facie* proof at least is given that my theory is sound in every respect.

In those papers I cited several instances showing that these non-volcanic earthquakes are the result of a purely mechanical force exercised by the movement of vast bodies of matter thrown from a slight to a greater depth on the sea's bottom, and that they are specially frequent where large bodies of alluvial deposits are formed upon clay; and when we seriously consider the remarkably uneven bed of those seas which constitute the earthquake centres of the world with the the known existence of overhanging banks—mushroom shaped cliffs—whose bases are ever being eroded by under currents and chemical action the wonder is not that earthquakes occur so often in those regions but rather that they are not at least of diurnal occurrence.

Before submarine cables were laid the effects of those mechanical forces could only be vaguely assumed but now whenever any of these masses which, in falling away cause the earthquake to originate, is in the direct path of any cable lying on the sea's bottom the result is a total interruption of telegraphic communication and the cable is invariably found ruptured by the sudden tension due to a vast subsidence, or it is buried completely by some thousands of cubic tons of matter precipitated upon it.

In no single case has absolute proof been wanting to confirm this — and when it is considered that no less than nine cables radiate from the island of Zante, laid along the course of known earthquake centres, some idea may be formed of the unique advantage I enjoy of prosecuting this research. Not only am I in a position to practically and electrically determine the exact centre

of the shock with a broken cable (such position being invariably confirmed by local data) but I am able to prove the absolute non-existence of volcanic agency by the thorough absence of any increase in the temperature of the water at or near the point of rupture and this is a question of the most vital importance.

I have already stated that the recent earthquake had precisely the same characteristics as that of 1873 the centre of which was some eight miles due east of Zante town.

The centre of the present shock was probably not more than six miles off—at a point where some, very great irregularities of the sea's bottom exist viz two miles E. N. E.—of cape Vassilikò some recent soundings gave no bottom at 500 fathoms where originally 300 existed. Very close to this sounding two overhanging cliffs are found their depth being under 250 fathoms and although our cables run clear of this place there is not the slightest doubt but that the quake originated here. No shock was felt at the Straits 36 miles S. of Zante nor were our Malta or Cretan cables affected by it.

At Catacolo and Pyrgos 25 miles E.S.E. of Zante all our shocks were felt strongly but did no damage.

At Gastouni 15 miles due E. — considerable damage occurred, but to the north only a very feeble shock was felt. The same applies to Cephalonia and therefore the accuracy of the seismograph's registry is fully confirmed by these observations.

Now it is very evident that this question of the inequalities of the sea's bottom, the chemical and electrolytical action due to the exposure after erosion of the metallic masses contained in the earth, under water, the consequent formation of immense caverns and resultant landslips, which probably release *large deposits of gas*, and to the existence of underground rivers—having frequently intercommunication with the sea—has never been sufficiently taken into account.

With the exception of Santorino there is very little ground for attributing volcanic origin to the islands of Greece and the Archipelago or to those parts of the mainland where seismic disturbances are so frequent: but there is direct evidence of these *Katabothra* — underground rivers with strong eddying currents—all over the Mediterra-

nean. Three cases where destructive earthquakes might be assumedly due to these denudations below the surface are worthy of mention.

On the southern coast of the Gulf of Corinth and about 20 miles from the entrance stands the town of Vostizza, noted for its fine currants. It is built on the sand hills rubble and loam deposits from the denuded mountains above. The port is very deep and the shoals each side of it have apparently been formed by the alluvial deposits, swept out into the port by the strong current of the *Katabothra* which runs under the town. After any strong shock the sea, inside the harbour becomes quite muddy and the water supply of the town, which is obtained from springs, or from this underground river is temporarily cut off. This town is periodically destroyed by earthquakes. In Cephalonia we find even a more remarkable *Katabothra*. Just at the entrance to the port of Argostoli a large body of water equal in bulk to about a million gallons a day runs into a very deep opening in the earth close to, and from the sea with a force sufficient to supply the motive power to drive two flour mills.

This body of water apparently goes right under and round the island and may have some connection with a vast cave also containing water which is to be found near Sainos opposite Ithaca. During the English occupation many barrels of oil were once sent into this hole and every measure was taken to ascertain if any of them came out into the surrounding sea but all appear to have been sucked down into the Vortex of some mighty whirlpool below. It requires very little imagination to connect this potent factor with the problem of the origin of these earthquakes! In Zante we have to the south-west of the island and near to the pitch-wells—a fathomless pool called the “abyss” the water in which is always at one level and is sucked into, and under the ground with a strong eddying current dragging down in its vortex any floating object thrown into it. From the direction in which this *Katabothra* runs the hollow condition of the surrounding soil, and the more pronounced state of the ruins along its assumed course there is no doubt but that it is in more or less direct connection with the fathomless depth already referred to in the sea from whence our shocks originate. If therefore we are prepared to attribute the

vibrative waves of earthquakes in non-volcanic regions—to a purely mechanical force we have abundant material upon which we may base the theory I have alluded to and which seems both practically and logically proven by actual facts.

The next point to be considered is that of earthquake motion and its distribution within a small area. In many districts shaken by earthquakes almost every observer of a shock describes it differently not only in point of strength but also as regards the direction of the vibrative waves. In the recent shocks here, the point from which they emanated was too pronounced to admit of any doubt as to their direction and the centrum was so near the ruined district that the strength was equally divided over the whole island except where earthquake “bridges” exist. The clearest way of describing earthquake motion is to compare it to the ripples produced on the surface of a pool of water when a stone is thrown into it. The first ripples are short and sharp and according to the size and bulk of the object thrown into the water so is their strength proportionally greater and the propagated waves reach further with a slower motion until equilibrium is again restored. So it is with the mechanical forces which disturb the surface of the sea’s bottom. The severity of the concussion caused by a mighty land slip is always proportionate to the bulk of the falling mass, the depth of its fall, the nature of the matter constituting it, and on to which it falls. The acceleration of the destructive motion of such masses falling under water would be greatly augmented also by the displacement of the water itself. If to this be added a subsidence as the cause or the effect of the land-slip the many small shocks preceeding and following the great ones can easily be accounted for.

Slow earthquakes are due to the slow movement of falling masses—velocity being given when the fall is rapid.

Of the surface nature of earthquakes we have abundant evidence. Neither in the present case nor in even more severe shocks have the tall Venetian towers which occupy a comparatively small space suffered whereas low out spreading buildings have been levelled with the ground. In the first instance the “wave” would have less surface on which to propagate its motion whilst in the second instance this would have been accelerated by the

greater surface covered. As already state the centre of the present disturbance was very near to the town and the motion of the shock felt there was precisely the same as the ripples of water just referred to. The vibrative waves struck one upon the other with great rapidity. Had it been otherwise or had the centre been a few miles further off not one stone would have remained upon the other as evidenced by the wholesale destruction in the villages where the motion was less rapid, but more destructive, from the accelerated and more developed waves of force.

Why certain districts suffered more than others from earthquake shocks appears to be entirely attributable to the nature of the soil—some tracts of ground being practically exempt from their effects whilst other are entirely devastated. It would seem as if the shocks pass beneath such a district as water passes beneath a bridge hence the term of earthquake bridges. When a vibrative wave passes from one bed of rock to another of a different character a certain portion of the wave is reflected while the remainder of it is transmitted and refracted, and bridges we may conceive of as occurring where the phenomenon of total reflection occurs. Many example of this are to be found in Zante from the recent shocks especially with reference to the stone walls built round fields and vineyards, wherever the subsoil is rocky solid and compact, not a stone is out of position but on the alluvial and loose soil they appear as if they had been subjected to some fierce cannonade. In one large village—Lithakia—the houses on the high ground wholly escaped damage, the soil being entirely of solid rock—lower down on the alluvium and under which the “abyss” runs not a house escaped—another very interesting fact, confirmed by personal observation, is that, wherever houses are situated on the borders of a rift, gully or any other steep cutting not the slightest damage has occurred, which is also a further proof of the surface nature of all earthquakes.

That the excessive damage done to the island is chiefly due to the bad construction of the houses is proven beyond doubt. In the village of Kiti from whence I have just returned out of 120 houses over 100 have been destroyed thrown down in such a way that one can scarcely credit the asser-

tion that nobody was killed. I saw one house a mass of beams, stones and plaster from which 12 people and three cows were dug out untouched and similar instances are cited by the dozen all over the island. Still the houses are disgracefully constructed and the wonder is how any escaped at all. That the earthquake was a very severe one is perfectly true but I am thoroughly convinced that had any attention been paid to the principles laid down for the construction of buildings in earthquake zones the damage would have been extremely insignificant.

As a proof of this I can cite my own house and the telegraph office both buildings constructed from good materials about sixty years ago and with a certain amount of regard to earthquake visitations. In my house a little plaster fell from the walls in the upper rooms, 50 feet above the ground but neither a tile nor a stone was thrown out of position and some idea may be formed of the size of the building when I state that the hall on the first floor opening into the rooms is 62 feet long by 20 broad, the rooms averaging 20 feet by 20. Of course light ornaments were thrown down and smashed but there was not the least material damage done to the main building—the detached kitchen, however, built of rubble just thrown together suffered severely. The same immunity was fortunately enjoyed by the telegraph station a building 70 feet high constructed most admirably. With the exception of a dozen tiles or so becoming loose and about six square inches of plaster fallen from one corner of the upper rooms there is not the slightest trace of the earthquake's passage. Both these houses have light compact roofs well bound by iron supports to the outer walls which seem to have been built with the very best mortar and sand. In both cases most of the rooms have the rafters alone for the ceiling and in the hall just mentioned there are 32 of these beams six inches square.

In examining the destroyed houses I invariably found that the primary cause of their destruction was a too heavy or an illproportioned roof which, when the vibrative waves struck the building crushed down the wretchedly jerry—built walls of rubble—with an occasional cemented corner stone here and there. The mortar I found to have been used most sparingly often in the proportion

only of once to twenty of *sea* sand and earth—wherever a good supply of mortar and stone was used the damage was most trifling even when the same subsoil was found below the respective foundations of the destroyed and uninjured houses.

In summarising the conclusions deduced from my observations I find the importance of acknowledging that earthquake motion is almost entirely propagated upon the *surface* of the earth and not below it, is almost paramount.

From a very elaborated series of experiments made at the seismological observatory in Japan to ascertain the motion of earthquake shocks on and below the surface a pit 18 feet deep by 4 feet square was constructed and the results obtained all tended to prove that motion was far less pronounced below than above the surface.

From a careful consideration of the destructive sea waves which frequent by accompany earthquakes it seems quite certain that they are entirely caused by some very great displacement of water, due to immense land slips and subsidences at the bottom of the ocean. This is especially noticeable on the west coast of South America, where destructive earthquakes invariably originate in the sea, which owing to its great depth and extension, have often caused waves to push inwards upon the coast 50 to 100 feet in height. The volume of these waves, the velocity with which they travel, and the violence of the seismic disturbance are entirely dependent upon the extension of the water, its depth and the cubic tonnage of the precipitated or subsided matter on the sea's bottom.

One distinct feature, noticeable during the recent shocks was the peculiar "bumping" sound which accompanied so many of them. This has been falsely attributed to an upheaval movement whereas it was simply the resultant motion produced by the masses falling on to the surface from a lower to a greater depth in the sea. To prove this fact it is necessary to again refer to the seismic experiments of the Japan Society. During the years 1880 to 1885 a heavy ball, 1710 lbs in weight was made to fall from various heights. Subsequently many elaborate experiments were made with charges of dynamite and gunpowder exploded in bore-holes, and the results obtained from both these series of experiments produced

exactly the same motion hitherto described as upheaving in earthquakes.

Once admitted that non-volcanic earthquake shocks are of a purely surface nature, then their origin can reasonably be traced to one or all of the causes I have endeavoured to describe.

As a further proof of the non-existence of volcanoes in these parts of the Mediterranean I have just received the very exhaustive and splendidly compiled report of the work done by the Imperial Austrian Surveying Vessel "Pola" during the past three years. At intervals of every half a knot the depth was taken, the surface mean and bottom temperatures, the density of the salts, the chemical analysis of the soil, rock etc. of the bottom carefully and thoroughly observed, classified and catalogued. Special mention is made of bottom and other erosive currents and the whole results bear out in a remarkable manner the observations I have alluded to at the beginning of this paper.

In conclusion I can only express a hope that by drawing the attention of scientists in general to a logically reasonable cause for these mysterious and destructive visitants, a greater impetus may be given to seismic research by all engaged in it—we must always bear in mind however that we are dealing with a motion feeble even when intense, developed upon this heterogeneous mass of solids, liquids and gaseous components constituting our planet, which is spinning on its axis at the rate of a thousand miles an hour and speeding through vacuous space either in its orbit round the sun, at the rate of one thousand miles a minute, and to consider the enormous volume of electricity and electro-magnetism generated on its surface by what after all is nothing but a huge electrical machine, which may have some very close relation with the points at issue on seismic origin.

Postscriptum

Since writing this paper a most striking confirmation of the marked relation between subsidence and earthquakes, has been afforded us by the recent landslips at Sandgate; and although the affected area there is only a mile in length by a few hundred yards in width it appears that the whole of the land in this small space is more or less "alive" and broken up into innumerable ridges by the subsidences. The gaping rifts in the houses,

the bulging walls, the deep furrows formed in the soil, and the swaying motion felt at the time the landslides occurred are all precisely identical with the phenomena experienced in our earthquake shocks here. Sandgate is comparatively level with the sea and yet the filtrated water and possible quicksands have caused great destruction—how much more severe this erosive action is when it occurs in the sea where immense over-hanging banks exist can easily be conjectured.

W. G. F.

The Future of the Races.

The epoch called the reign of humanity, observes Dr. G. Binet, is nearing its summit. What will become of the different human races is a problem M. Zaborowski, the distinguished anthropologist, has attempted to solve. The globe has now a billion and a half of people, which will doubtless be doubled in a very short time. People representing about one fifth of humanity now visit all parts of the globe, and are gifted with a power of expansion never before realized. Their civilization will efface all distinctive race peculiarities. In the greater part of the races will disappear, but for a long time, in certain conditions of climate, there will be a place at the side of the Europeans for very different races, endowed with ability to work, and thus capable of competing for a great part of the globe. These races are not very numerous, but at their head is the Chinese, who alone represent one third of humanity. Others will disappear in a more or less distant future. Among these are the Lapps, many of the inhabitants of ancient Asia, the Veddash, the Malays, the little blacks of the Philippines, of Borneo and all the other people who for thousands of years have rejected all culture and are the only survivors, surprising to themselves, of an almost vanished age. These include also the Indians of North America and the natives of Polynesia. Less than three centuries ago, outside of China and Europe, the whole world was peopled with savages, and in less than three centuries more these races will have disappeared and been replaced by the descendants of the European races, having as auxiliaries as many Chinese and Negroes as are adapted to the needs of civilization.

Variation in Skin Colour

The causes which give rise to the many variations in the colour of the skins of men and animals offer themselves as a most interesting though difficult subject for study. According to the observations of Professor Robert Wallace who has devoted a considerable amount of attention to the subject, the cattle of India, like the people, have usually black skins.

This circumstance that the skin of cattle in India is generally black opens up wider the scope of a most interesting question on the relation of colour to climate. According to Professor Huxley—a recognised authority of distinction upon the subject—this relationship is by no means at present understood. The field of investigation as regards India is a large one it embraces the human races, and the breeds of cattle, sheep, pigs, buffaloes, and horses. The skins of all these are black or dark coloured. The few white exceptions noticed by Mr. Wallace were in buffaloes and cattle which were unhealthy. The white or grey hair so prevalent in cattle extends to the Arab horse, and would appear to be, when associated with the black skin, especially adapted to resist the intense heat of a tropical sun. When it is known to be a scientific fact that white does not absorb heat so quickly as black, it seems paradoxical that the skin should be black instead of white in India and the tropics. And it is even more wonderful that the skin of the lower animals should follow the same great natural law so antagonistic to scientific conclusions.

However, though it would seem at first sight that the black skin should be a disadvantage on account of its quick absorption of heat, it is not really so. The black colour of the skin causes it to absorb more heat than a white skin, but while it is doing so, at the same time and for the same reason, that is, its radiating power corresponds with its absorbing power. Therefore, in the Professor's opinion, when the sun's rays impinge upon the skin, the heat is rapidly absorbed; but, as the rate of absorption of heat is greater than the rate of radiation unless the temperature of the skin were lowered

by some other influence, the whole surface of the body would become extremely hot.

To complete the explanation he takes into into consideration what is known of black-skinned men. When he was in India he observed that natives, although they drank water freely, do not appear to perspire so copiously as Europeans, but this apparent absence of perspiration is owing to the freer exudation of invisible moisture in the form of vapour. Sweat-drops are not seen on the skin, but an enormous quantity is constantly evaporating and the moisture exuding from the skin, there is a demand for heat for greater than an ordinary observer would imagine; and by it can be disposed of all the surplus heat which the black skin absorbs over and above what it gives off by radiation. This fact, so ably dwelt upon by Mr. Wallace, is realised by few, that the amount of water is small indeed which, by being evaporated, could transform into its latent condition all the heat derived from the warming influences of the sun in the hottest climates.

The Marls and Clays of the Maltese Islands.

By J. H. COOKE, Esq., B.Sc., F.G.S.

INTRODUCTION.

In the year 1843 the late Admiral Spratt published a brief notice on the above subject, and a few years afterwards the late Prof. Gullia and Capt. Hutton (1) alluded to the Marls and Clays in their sketches of Maltese geology. The late Prof. Leith Adams published in 1870 a short account of them in his 'Notes of a Naturalist,' but the amount of information that he gives as to the nature of the beds and of their fossil contents is neither very extensive nor very exact. In 1874 the Islands were visited by Thos. Fuchs, of the Imperial Geological Museum of Vienna, and by him the first attempt was made to correlate the Maltese formations with those of Central Europe. In the first of his two pamphlets on the subject he tells us that he was inclined to consider the Maltese Marls as being analogous to the 'Badner Teufel' of the Vienna Basin: but two years later,

after having examined the marls of Bologna and compared their fossil contents with those of the Maltese beds, he changed his opinion and referred them to the Austrian Schlier. In 1889-90 Dr. J. Murray, of Edinburgh, visited the Islands; and in the paper (2) which was published on his return to Scotland he gave the first detailed account of the nature and constitution of the Maltese rocks, that had so far appeared. His descriptions were, however, exclusively lithological; and, excepting the list of 122 species of foraminifera which is appended to the report on the Maltese Marls, no information is given either as to the stratigraphy or paleontology of this particular information.

Before Dr. Murray's arrival I had already devoted a considerable amount of attention to the Marls and Clays; and owing to the kind encouragement which I received from him I continued my investigations after his departure, with the result that I have been able to add largely to our knowledge of the fossil fauna and to gather together a number of important facts bearing on the geological history of the Maltese Islands. I am under great obligations to Prof. Capellini and Dr. Simonelli for the interest they have shown in my work and for the valuable assistance they have rendered me in determining the organic remains found in the strata.

The following is a chronological list of the published notices and memoirs having reference to this subject:—

- 1843. Spratt, T. 'On the Geology of the Maltese Islands.' Proc. Geol. Soc. vol. IV. p. 225.
- 1860. Gullia, G. 'Geologist' (Notes and Queries) for 1860, p. 421.
- 1864. Adams, A. L. 'Outline of the Geology of the Maltese Islands.' Ann. & Mag. Nat. Hist. ser. 3, vol. XIV, p. 1.
- 1866. Hutton, F. W. 'Sketch of the Physical Geology of the Island of Malta.' Geol. Mag. for 1866, p. 145.
- 1870. Adams, A. L. 'Notes of a Naturalist in the Nile Valley and Malta.' Edinburgh.
- 1874. Fuchs, Th. 'Das Alter der Tertiärschichten von Malta.' Sitzungsber. d. k. k. Akad. der Wissensch. Wien, vol. LXX. p. 92.

(2) *The Maltese Islands, with special reference to their Geological Structure* Scot. Geogr. Mag. vol. VI. (1890) p. 449.

(1) See *Geol. Mag.* for 1866, pp. 145-152, pls. VIII & IX.

1876. Fuchs, Th. 'Ueber den sogenannten Badner Tegel auf Malta.' Sitzungsber. d. k. k. Akad. d. Wissensch. Wien, vol. LXXIII, p. 67.
1879. Adams, A. L. 'On Remains of *Mastodon* and other Vertebrata of the Miocene Beds of the Maltese Islands.' Quart. Journ. Geol. Soc. vol. XXXV. pp. 517-530.
1890. Murray, John. 'The Maltese Islands, with special reference to their Geological Structure.' Scot. Geogr. Mag. vol. VI. p. 449.
1891. Cooke, J. H. 'Notes on the Pleistocene Beds of Gozo.' Geol. Mag. for 1891 p. 348.

1891. Gregory, J. W. 'The Maltese Fossil Echinoidea and their Evidence on the Correlation of the Maltese Rocks.' Trans. Roy. Soc. Edin. vol. XXXVI. p. 585.

PHYSICAL FEATURES AND GENERAL DISTRIBUTION OF THE STRATA.

The Maltese Marls and Clays occupy the third place both in the ascending and the descending order of the Maltese formations. The following table shows the order in which the beds occur, as well as the relation that they bear to the continental deposits.

Tabular Summary of the Maltese Rocks and their Equivalents in the Vienna Basin.

THE MALTESE ISLANDS.				VIENNA BASIN.	
No.	Formation.	Thickness.	Subdivisions.		Series.
5.	Upper Coral. Limestone	250 feet.	{ <i>a.</i> Compact white Limestone, of a breccialike texture. <i>b.</i> Soft, porous, red Limestone. }	Leithakalk.	Torton.
4.	Greensands	50 feet.	{ <i>a.</i> Compact yellow Sandstone. <i>b.</i> Friable black Sandstone. }	Gründer Schichten.	Helvet.
3.	Clays.....	30 feet.	{ <i>a.</i> Yellow Clay. <i>b.</i> Blue Clay and Marl. }	Schlier.	Langhian
2.	<i>Globigerina</i> -limestone	200 feet.	{ <i>a.</i> Upper <i>Globigerina</i> -limestone (variously coloured beds of freestone, interstratified with from three to six nodule-band). <i>b.</i> Lower <i>Globigerina</i> -limestone. }	Horner Schichten.	
1.	Lower Coral. Limestone	500 feet?	{ <i>a.</i> Semi-crystalline Limestone. <i>b.</i> Non-crystalline Limestone. }	Solszka Schichten.	Aquit.

The formation known as the 'Clays' consists of marls and clays varying considerably in their lithological characters as well as in their distribution. It lies conformably between the *Globigerina*-limestone and a Greensand formation, but so obscure is the line of demarcation between it and the *Globigerina*-limestone and so striking are the resemblances of the fossil fauna of each, that we seem to be justified in considering the Clay as being merely an argillaceous division of the formation upon which it rests.

In Malta the formation is developed only in the northern and north-western districts, where it extends over about one third of the total area of

the island. But in Gozo, where the forces of denudation have been more actively at work, it is so scattered among the hills and plateaux that its aggregated area would not amount to more than one fourth of that of the island in which it occurs (see fig. 1, p. 120).

In common with all the beds of the Maltese group this formation has been, then, extensively denuded. The remnants of the Clays that occur in the Dueira Valley, in Gozo, and in the caves, fissures, gorges and valleys of both islands, show that at one time the formation probably extended much farther than it does at present.

In the western part of Malta the Clays crop out from the sides of the plateaux and along the valleys of the Binjemmas; indeed, but for the numerous parallel faults that intersect this part of Malta and the eastern half of Gozo, the Clays would form a continuous bed extending from Gebel Ciantar in the south-east of Malta to Giurdan in the north of Gozo. These faults have broken the continuity of the bed and have caused many parts of it to descend to lower levels. At St. Paul's Bay the outcrop of the Clays is 150 feet lower than is that which occurs at the western extremity of the Great Fault of Malta; and in Melleha Valley the strata between the two faults that form the boundaries of the bay have been let down to such an extent as to completely submerge, not only the Clays, but also the beds that lie above them. These faults and the sections in the shafts at Boschetto and Gomerino, the road-sections at Gebel Imtarfa and the outcrops at Chelmus, Madonna della Kala Ghain Toffiha, Chambray, and Giurdan are the places that are best adapted for studying the formation.

The surface-contour of Gozo is more diversified than that of Malta and with the exception of the depressed area which lies to the south of the Gozo Great Fault the strata preserve a more uniform horizontality than they do in the sister isle. In

both islands the Clays are usually overlain by the Greensand; but to this order there are several well-marked exceptions. At Ghain Toffiha, in the north-west of Malta, the Clays are overlain by the Upper Coralline Limestone (bed 5), the Greensand, being entirely absent, and at Boschetto, Nadur, and Gebel Ciantar the same order is to be observed. In Gozo the Clays invariably occupy their normal position between beds 4 and 2, except at Chambray, Dneira, and Marsa-el-forno, where the complete denudation of the Upper Coralline Limestone and of the Greensands has left the Clays exposed as the surface-deposit. Similar surface-exposures are to be observed in Malta at Karraba and Melleha.

The thickness of the formation has been variously estimated. Both Hutton (1) and Adams (2) considered that it attained a maximum thickness of 100 feet and more, while Dr. John Murray says that it "probably rarely exceeds 20 feet." The result of the numerous measurements that I have made of the outcrops, of the cliff-sections, and of the sections in the well-shafts in the Binjemmas, proves that the latter estimate is much nearer the truth than the former. The following table of measurements will show the extent to which the thickness varies in different parts of the Islands:—

No.	LOCALITY.	THICKNESS.	REMARKS.
1.	Ghain Toffiha, Malta.	about 50 feet.	These localities are in a line running due N.E. and S.W.
2.	Chambray, Gozo.	" 30 "	
3.	Ras-el-Kammieh, Gozo.	" 50 "	
4.	Xaghra Hill, "	" 40 "	
5.	Dabreni, "	" 40 "	These localities lie west of the above mentioned line.
6.	Chelmus, "	" 40 "	
7.	Dneira, "	" 20 "	
8.	Giurdan, "	" 40 "	
9.	Ghar Ilma, "	" 40 "	These localities are in a line running N.E. and S.W.
10.	Gebel Ciantar, Malta.	" 15 "	
11.	Boschetto Valley "	" 25 "	
12.	Città Vecchia, "	" 20 "	
13.	Gebel Imtarfa, "	" 14 "	These localities lie west of the above mentioned line.
14.	Ta Binjemma, "	" 15 "	
15.	Wardia, "	" 20 "	
16.	Selmone, "	from 10 to 20 feet.	
17.	Dingli, "	" 6 to 10 "	These localities lie west of the above mentioned line.
18.	Gomerino, "	about 22 feet.	
19.	Fom-ir-Rieb, "	" 3 "	

(1) 'Sketch of the Physical Geology of Malta,' *Geol. Mag.* for 1866, p. 145.

(2) *Quart. Journ. Geol. Soc.* vol. xxv. (1879) p. 519.

(To be continued.)

SCIENCE GOSSIP

ON the 1st instant at 8.10. a. m., a strong shock of earthquake was felt at Catania, Belpasso, Viagrande, Brancavilla, Randazzo, Giarre, Acireale and Mines. At Nicolosi and Zaffarana considerable damage was done to house property, and a panic among the people followed.

WE desire to draw the attention of our readers to several important changes which we propose to make in Volume III. Original articles will, in future, be published in either the English, French, or Italian languages. It is also our intention to enlarge the journal and to publish it six times a year instead of twelve times as heretofore.

Our next issue, which will commence Vol. III, will appear on June 1st. 1893.

WHILE the netters, trappers, and other quasi-sportsmen are pursuing their nefarious designs against the bird-life of these islands insect life rapidly increases apace, and already loud and bitter complaints are being made about the damage which the extraordinary abundance of slugs, snails *et hoc genus omne* is causing among the agricultural produce of the islands.

THE orange-grower in particular has now one more foe to add to the already large number which assails his interest. From observations made by Professor N. Tagliaferro in a number of gardens at Musta it appears that the orange crop is likely to be considerably diminished this season owing to the damage which has been wrought among the fruit by the snail *Helix aspersa*. And who is there that will now defend the slaughter of our feathered friends, and assert that insectivorous birds are not required in the Maltese Islands!

AN Austrian physician named Dr. Fere read a paper before the Entomological Society of France about two years ago in which he propounded the remarkable theory that those persons who had been stung by bees enjoyed an immunity from the effects of bee-stings for periods of varying lengths; and that the virus of the bee-sting was an infallible remedy for acute rheumatism.

THIS theory has received most unquestionable confirmation from the practices of the country people in Malta. Great quantities of sulla (*Coro-*

narium hedysarum) are grown in the islands; and as the bees are particularly fond of it, and it imparts to the honey that delicious flavour for which the Malta honey has so enviable a reputation, the Maltese countryman invariably has one or more hives in the vicinity of his clover fields. Bees are therefore plentiful in the island. The virtue of the bee sting as a cure for rheumatism has long been established in the island and it has been a common practice for generations past to resort to this primitive method of inoculation in all severe cases, and, as the patients aver, with most favourable results.

WE would again invite the attention of Mediterranean Naturalists to that very valuable review of Italian geological science which is issued under the joint editorship of Messrs M. Cermenati and A. Tellini. This, the fifth number of the "Rassegna della scienza geologica in Italia" is, in no respects, less interesting or less useful than its predecessors.

THERE are about six species of figs grown in the Maltese Islands the smallest but most luscious of which ripens during the month of June and is known among the country people as "St. John's fig."

All of the species are small but they are quite equal in flavour to any of the species which grow in other countries around the Mediterranean.

The methods of *caprification* practised by the Maltese country people are curious and instructive. About the month of November the fruit of the wild fig known as "*barra*" begins to grow as soon as the leaves of the tree fall. It is not edible, and it is therefore left on the tree until the commencement of spring when another crop of figs known as "*dukkara*" appears on the same tree. The blastophagus from the "*barra*" then fertilizes the "*dukkara*". In the month of May the "*dukkara*" are gathered from the tree and are tied by means of string to the branches of the domesticated fig trees. The processes of *caprification* then rapidly proceeds and the figs reach maturity in about two weeks.

THE remarkable observation has been made that the most civilized of ancient races lived in dry districts. Prof. Hilgard attributes this to the fact that necessary mineral plant-food is much

more abundant in dry soil than in wet. In dry regions simple irrigation yields a bountiful harvest while moist soil is quickly exhausted.

"NATURAL Science" for March has, as usual, a series of most interesting and valuable contributions among which we note "The Nucleus in some Unicellular Organisms by Rev. W. H. Dallinger, L.L.D., F.R.S. "Are Great Ocean Depths Permanent?" by Professor Edward Suess Ph., D. "The Origin and Classification of Islands" by A. J. Jukes—Browne B. A., F. G. S. "Biological Theories" by C. H. Hurst Ph. D., Recent Observations on Fertilisation and Hybridity in Plants "by A. W. Bennet M. A., F. L. S. and "Animal Temperature" by M. S. Pembrey M. A., M. B.

SITUATED as the Maltese Islands are in the middle of one of the most interesting regions in the world it is but natural that they should, in common with the countries around them, be much resorted to by curiosity hunters. At the present time a thriving trade is being done in reputed Phœnician, Greek, and Roman relics, in Lace, in Filigree work, and in Maltese Dogs.

HUNDREDS of dogs of more or less doubtful origin annually change hands at prices varying from a few shillings to as many pounds apiece. That the *Maltese dog* is now extinct is, however, a fact which appears to trouble neither seller nor buyer at the time of the bargain driving. Aristotle was one of the first writers who drew attention to the remarkable breed of dogs for which the Maltese Islands were so long famous, and he notes that they were specially sought after by Greek and Roman ladies on account of their beautifully proportioned forms and their diminutive size.

A stuffed specimen of one of these dogs is still preserved in the Malta University Museum. It has long silken hair and measures 5 inches in length, and 3 inches in height.

EVIDENCE that a copper age existed before the discovery of bronze has been found by M. Berthelot. A piece of copper from Mesopotamia, taken from ruins more ancient than even those of Babel, proves to be free from both tin and zinc; while a piece of a metallic scepter, supposed to have belonged to a Pharaoh in Egypt some 3500 years B. C., is also shown to be nearly pure copper.

THE idea that the oak and certain other trees are particularly subject to destruction by lightning, while the laurel and others are free from danger, has been investigated by P. Jenesco. The conclusion is reached that no trees are exempt from risk. Trees containing oils are less liable to be struck, those with most oil being best protected; while lightning seems to prefer trees containing much starch, and those which have little oil in summer. Dead limbs of either starch or oil containing trees are especially liable to be struck. Neither the quantity of water contained in the tree nor the character of the soil in which it stands appears to have any influence.

CERTAIN speculations make it appear, according to M. Raoul Pictet, that chemical affinity must be absent at the temperature of absolute zero—that is, 5750 C. below the melting point of ice. Experiment confirms this belief. At about 150° below zero, chemical action has been found to be weak, sulphuric and nitric acids having no effect upon potash, and potassium remaining unchanged in oxygen. Entirely new combinations, moreover, have been effected by the action of the electric spark on substances maintained at that temperature.

WHY the moon—unlike most globes known to us in space—should have no atmosphere has long been a perplexing question. Sir Robert Ball, of Cambridge University, states that this may now be explained as a necessary consequence of the kinetic theory of gases, this theory teaches that any gas is composed of molecules in very rapid motion. The molecules of hydrogen are the most active of all, and at ordinary temperatures they move at an average rate of more than 6000 feet per second. The average motion of molecules of oxygen and nitrogen is much less, but individual molecules frequently attain velocities greatly in excess of the average. This latter fact is important. The mass and dimensions of the moon are such that if a body were projected from it at the rate of about a mile per second lunar attraction would be overcome, and the body would not return. With an atmosphere of oxygen and nitrogen, the moon would by its attraction keep the molecules when at average velocity. But occasionally molecules in the upper

air would dart outward at more than a mile per second, and be lost in space; and as this would be repeated continually, such an atmosphere could not be permanent on the moon. On the earth a copious atmosphere is retained for the reason that our globe is so massive that a projectile could escape from its attraction only when given an initial velocity of about six miles per second—a rate seldom or never reached by molecules of oxygen or nitrogen.

IN the sixteenth and seventeenth centuries, navigators reported huge land tortoises in two widely separated regions—the Galapagos islands in the Pacific, and several islands in the Indian Ocean. The tortoises were taken from Mauritius and Reunion, but seen to have been particularly numerous in the smaller island of Rodriguez. From these islands they were in 1761 being sent by thousands to Mauritius, but early in the century extermination was here complete and only in the little island of Aldabra are a few specimens of the tortoises now known to be living in a wild state. Steps are being taken to preserve these individuals, and to introduce them into other islands. Two tortoises—2½ feet high, with a shell 9½ feet in circumference—are still living.

AN extraordinary natural history has Madagascar, declares Canon Tristram. One would suppose that this would be that of Africa, but it is so unlike as to prove that the island has been separated from Africa for an immense period of time. Its animals and plants, as well as its people, have a far greater resemblance to those of India than to those of the near mainland. The monkeys and lemurs of Madagascar are not to be found in Africa, while all the great African animals of prey are absent. Among the lemurs is one known as the ayeaye, the formation of whose digits is unique. The egg of an extinct bird of Madagascar is fifteen times the bulk of that of an ostrich, and yet the bird itself does not appear to have been larger than the New Zealand moa, an extinct bird to which it had an affinity. This same peculiarity runs through all the birds of Madagascar. The water-birds and sea-fowl are of course those of Africa, but there are one or two extraordinary exceptions. The beautiful snakebird, allied to

the cormorant is an Indian species. There is also a water-hen which is peculiar to Madagascar, and which has the remarkable features of a long tail and long foot. It is a great puzzle to naturalists. A group of cuckoos is peculiar to the island, with no relations in Africa or India; while a bird allied to the thrushes is not African but is allied to a species in the Mauritius and all the Mascarene islands.

The Sandgate Landslip. (1)

By W. TOPLEY, F.R.S.

The sea-front of the coast near Folkestone, Hythe, and Sandgate has long been known for its tendency to slip, and numerous examples of landslips, small and large, are there to be seen. In all these cases the cause of the slip is the geological structure of the ground, the strata consisting of alternations of pervious and of more or less impervious beds. At Eastwear Bay, between Folkestone and Dover, there is a huge tumbled mass of chalk, known as "The Warren," which has slipped over the impervious gault clay. As we proceed from east to west along the shore lower strata occupy the surface. Folkestone is mainly built on the highest division of the lower greensand—sands, sandstone, and hard calcareous bands, known as the Folkestone beds; these underlie the gault, and they overlie a set of clays and sandy clays known as the Sandgate beds. Where the latter beds crop out the old landslips begin, and they continue westward along the shore. The town of Sandgate is built on an old landslip of the Sandgate beds, and the recent slip is only a small movement in the old slip. West of Sandgate the Hythe beds rise from beneath the Sandgate beds. These are bands of limestone and calcareous sandstone; they rest on Atherfield clay. The Atherfield clay, along its whole length for many miles to the west, has slipped more or less over the weald clay which underlies it, often bringing down masses of the overlying Hythe beds.

Three miles to the west of Hythe are the remains of Studfall Castle, a Roman fortress built on the slope of the hill on Atherfield clay. This castle was destroyed by a landslip which probably

(1) From the "*Geographical Magazine*" April 1893.

occurred before the Norman Conquest. In *The Gentleman's Magazine* for 1756 (vol. xxxvi, p. 160) there is an account of a landslip which occurred near this place in 1725. The slip occurred during a very wet season. A farmhouse slid down about 50 feet during the night, so gently that, it is said, the people inside were not aware of what had happened until in the morning they were unable to open the door. A similar gentle movement of the ground is apparent at Sandgate, where, during the recent slip, a greenhouse was wrecked, but it fell so slowly that most of the glass was unbroken. Slips frequently occur along the Atherfield clay near Hythe. Small movements of this kind occurred at the same time as the recent Sandgate landslip.

Behind the town of Sandgate there is a high cliff of Folkestone beds, below which come the Sandgate beds. At the western part of the town there are the Hythe beds, which also appear as rocks on the shore in front of the town. The dip of the strata is towards the north-east; the normal dip is gentle, but high dips are sometimes seen which may be due to slips. A deep cutting for a sewer is now open on the slope near the centre of the town. The effects of the old landslips are evident here, for below sandy clay of the Sandgate beds there are masses of peaty stuff containing recent plants. This old landslip must have been far more extensive than now appears, for its seaward front had been worn back by the waves before the town was built.

Special local causes may possibly have some influence in determining the exact position and origin of any landslip along this coast; but the main cause is always the same—the saturation of the land by heavy rains. The nearest rain-gauge to Sandgate is that at Hythe where observations have been taken for many years by Mr. H. B. Mackeson, F.R.S. The average rainfall for February at Hythe, during the ten years 1883-1892, was 1.95 inch, with 13.8 wet days. This year the fall was 4.3 inches, twenty-four out of the twenty-eight days being wet; 1.06 inch fell on one day (February 21st).

The Sandgate beds, in their undisturbed state, are only moderately retentive of moisture, from the large amount of clay which they contain; but when in a slipped and broken condition, as at

Sandgate, they can contain a great deal of water. The recent excessive rains saturated the ground, and rendered the whole mass unstable.

The recent slip took place along an area 2775 feet in length, with a maximum breadth of 700 feet, measured from the back of the Encombe grounds to high-water mark. The foreshore was also moved for a breadth of perhaps 300 feet in all. The extreme eastern limit is the eastern end of the coastguard station; the western limit is just opposite the centre of the Military Hospital. The greatest vertical movement seems to have been about 10 feet—this is in the Encombe grounds; the horizontal movement of the slip is also small. The maximum effects are to be seen in various places in and near the Encombe grounds; fortunately, there are few buildings here.

The rocks on the shore were slightly moved, a bed of clay being ridged up about 4 feet. This movement of the rocky Hythe beds, and of the clay lying near, was probably due entirely to pressure from the moving mass of Sandgate beds.

As a "landslip" the movement is a comparatively small affair, and would have attracted but little attention were it not for the damage to houses; this unfortunately, is large. No dwelling-house actually fell, but many are so much injured that they must be taken down.

The prevention of future slips is a simple matter, though necessarily a costly one for so small a place. Deep drains must be carried along the back of the undercliff, to carry off the water percolating from the Folkestone beds above; the undercliff must also be thoroughly drained, and no surface-water, other than that due to the rainfall on the area itself, must be allowed to enter the ground. This is the plan recommended to the local board by Mr. Baldwin Latham.

Much has been said about the probable effects of blowing up two wrecks off the shore—the *Calyпсо* in June 1892, and the *Benvenue* between September and December 1892. But any effect due to the former should have been felt long ago. The vibrations caused by the *Benvenue* explosions seem

(1) In *Symon's Monthly Meteorological Magazine* for March there is an account of "The Sandgate Disaster," giving details of the February rainfall in East Kent, the fall varying in six stations from 3.06 to 4.50, that at Hythe being the largest.

to have been no greater on the shore than those made by heavy storms at spring tides; but they of course shook the land behind more than such storms do. It is impossible to say that these explosions had no effect in rendering the land more unstable; but sufficient other causes for the landslip are apparent, and similar though smaller slips occurred along the coast in other places where these explosions could have had no influence whatever.

Another cause which may have partially assisted is the want of shingle on the foreshore. A sea-wall with groynes has been built on the east of Hythe; this largely stopped the eastward movement of

shingle, and the sea-front of Sandgate suffered. New groynes have, however, now been built here and the shingle is again accumulating. If the want of shingle were the real cause of the slip its effect ought to have been felt some time back in wet weather. The want of support to the foreshore may possibly have had some effect in determining the exact time of the slip, when the ground became fully saturated, for the first important slip occurred at 7 P.M. on Saturday, March 4th, at low spring tides: the ground moved slightly during the night, and a second slip took place at low tide the next morning.

Meteorological Report.

Lat. 35° 55' N. Long. 14° 29' E.
Barometer Readings reduced to 32° F. at sea level.

ST. IGNATIUS' COLLEGE MALTA.

February 1893.

Results of observations taken during the month.

								Average 10 years
Mean Reading of Barometer	...	...	...	...	...	inches	30.096	30.020
Highest "	on the 1st	...	...	...	...	"	30.366	30.320
Lowest "	on the 22nd	...	...	...	...	"	29.713	29.623
Range of Barometer Readings	...	...	...	...	...	...	0.653	0.697
Highest Reading of Max. Therm: on the 25th	...	...	...	...	...	...	68.9°	67.1°
Lowest Reading of Min. Therm: on the 6th	...	...	...	...	...	...	41.7°	41.7°
Range of Thermometer Readings	...	...	...	...	...	...	27.2°	25.4°
Greatest Range in 24 hours on the 15th	...	...	...	...	...	...	18.0°	19.6°
Mean of all the highest Readings	...	...	...	...	...	...	61.2°	60.1°
Mean of all the lowest Readings	...	...	...	...	...	...	49.1°	48.9°
Mean Daily Range	...	...	...	...	...	...	12.1°	11.2°
Mean Temperature (deduced from Max: and Min.)	...	...	...	...	...	...	54.1°	53.5°
Mean Temperature (deduced from Dry Bulb.)	...	...	...	...	...	...	54.1°	53.8°
Adopted Mean Temperature	...	...	...	...	...	...	54.1°	53.7°
Mean Temperature of Evaporation	...	...	...	...	...	...	49.5°	49.5°
Mean Temperature of Dew point	...	...	...	...	...	...	46.5°	46.6°
Mean Elastic force of Vapour	...	...	...	...	...	inches	0.317	0.319
Mean Weight of Vapour in a cubic foot of air	...	...	...	...	...	grains	3.6	3.6
Mean additional weight required for saturation	...	...	...	...	...	"	0.9	0.8
Mean degree of Humidity	...	...	...	...	...	...	81	82
Mean Weight of a cubic foot of air	...	...	...	...	...	grains	542.2	540.8
Fall of Rain	...	...	...	...	...	inches	1.768	2.087
Number of days on which Rain fell	...	...	...	...	...	...	7	10
Mean amount of Cloud (an overcast sky = 10)	...	...	...	...	...	...	4.1	4.7
Total number of miles of Wind indicated	...	...	...	...	...	...	7817	7675
Mean Velocity of Wind per hour	...	...	...	...	...	miles	11.5	11.3

REMARKS

Dew Point: ranged between 32.7° on the 8th and 54.7° on the 28th.

In Sunshine: the highest reading was 122.1° on the 26th.

On Ground: the lowest reading was 36.3° on the 8th.

Lightning was seen on the 4th. and 23rd.

Total Rainfall since last June 23.154 inches; the average of 10 years, 16.882 inches.

1st, March 1893.

(Signed) JAMES SCOLES, S.J.





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"	" Malta ...	17	10	}...20% reduction, returning within 4 months	
"	" Brindisi ...	17	10		
"	" Alexandria ...	20	12	£32	£20
"	" Port Said ...	21	13	}...20% reduction, returning within 4 months	
"	" Ismailia ...	22	14		
Genoa	to Alexandria ...	13	9 10/-	£21 10/-	£15 10/-
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"	" Port Said ...	13	10	}...20% reduction, returning within 4 months	
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